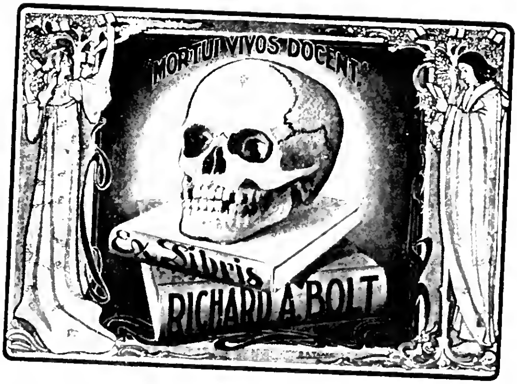
R. A. Bolt
Ann Arbor, 1904

No. 1.

Healthy Homes and Foods for the Working Classes.


"MORTUI VIVOS DOCENT"
Ex Libris
RICHARD A. BOLT

American Public Health Association

LOMB PRIZE ESSAY

HEALTHY HOMES AND FOODS FOR THE WORKING CLASSES

By VICTOR C. VAUGHAN, M. D., Ph. D.,
Professor in University of Michigan

HE WHO SECURES A HEALTHY HOME AND HEALTHY FOOD FOR HIMSELF AND FAMILY DOES NOT LIVE IN VAIN

Concord, N. H.
REPUBLICAN PRESS ASSOCIATION, 22 NORTH MAIN STREET
1886

INTRODUCTION.

As the result of prizes offered by Mr. Henry Lomb, of Rochester, N. Y., through the American Public Health Association, the following awards were made at the last meeting of the association:

I. HEALTHY HOMES AND FOODS FOR THE WORKING CLASSES. By VICTOR C. VAUGHAN, M. D., PH. D., Professor in University of Michigan. Prize, . . . $200

II. THE SANITARY CONDITIONS AND NECESSITIES OF SCHOOL-HOUSES AND SCHOOL-LIFE. By D. F. LINCOLN, M. D., Boston, Mass. Prize, . . . $200

III. DISINFECTION AND INDIVIDUAL PROPHYLAXIS AGAINST INFECTIOUS DISEASES. By GEORGE M. STERNBERG, M. D., Major and Surgeon U. S. Army. Prize, . . . $500

IV. THE PREVENTABLE CAUSES OF DISEASE, INJURY, AND DEATH IN AMERICAN MANUFACTORIES AND WORKSHOPS, AND THE BEST MEANS AND APPLIANCES FOR PREVENTING AND AVOIDING THEM. By GEORGE H. IRELAND, Springfield, Mass. Prize, . . . $200

That these essays may be placed in the hands of every family in the country is the earnest desire of the association, as well as the heartfelt wish of the public-spirited and philanthropic citizen whose unpretentious generosity and unselfish devotion to the interests of humanity have given us these essays, but the financial inability of the association renders it impossible to distribute them gratuitously;—therefore a price covering the cost has been placed upon these publications. It is to be hoped, however, that government departments, state and local boards of health, sanitary and benevolent associations, etc., will either publish these essays, or purchase editions at cost of the association, for distribution among the people.

Although a copyright has been placed upon these essays for legitimate protection, permission to publish, under certain conditions, can be obtained by addressing the secretary.

Healthy Homes and Foods for the Working Classes.

COMMITTEE OF AWARD.

Dr. E. M. Moore, President State Board of Health, Rochester, N. Y.
Dr. C. W. Chancellor, Sec'y State Board of Health, Baltimore, Md.
Medical Director Albert L. Gihon, U. S. Navy, Washington, D. C.
Dr. J. H. Raymond, Health Commissioner, Brooklyn, N. Y.
Major Charles Smart, Surgeon U. S. A., Washington, D. C.

I.

BUILDING A HOME.

LOCATION.

The location of the home of the working-man is often determined by considerations over which he has no control. Cost of land and distance from place of labor must influence the selection. If possible, however, the house should not be located in a low, damp place, nor on made earth. In cities, many low tracts, and even the beds of small streams, marshes, and lakes, are filled in with general refuse, such as street sweepings, back-yard rubbish, ashes, and garbage. Such soil, unless thoroughly under-drained, must be unfit for the location of habitations. It is damp, and will for years be filled with the products of decomposition arising from the putrefaction of the garbage deposited there. Houses built in such locations must be damp, musty, and unhealthful. The inmates of a house built in such a place are likely to suffer from malaria, bilious fever, and rheumatism, even if they do not fall victims to the more dreaded diseases, typhoid fever and consumption. The house should also be far from marshes and other low lands, whose surface is covered with water in the spring and early summer, and then exposed later. Such situations are likely to be malarious. Neither should the home be located near manufacturing establishments which usually have much garbage about them, such as breweries, tanneries, glucose factories, rendering houses, and oil refineries.

The site should be one which is naturally well drained; and whether this be the case or not often cannot be decided in cities without consulting maps which show the original lay of the land before any grading had been resorted to, though the position and course of neighboring streams and the location of springs may suggest valuable information. The slope of the land should be from the house. Extra precaution must be taken when it becomes necessary to build at the foot of a hill which is covered with houses from which the surface water and under-ground drainage flows toward the home. The location of neighbors' out-houses, with reference to the proposed home, should also be taken into consideration. While an intelligent man will not neglect the sanitary condition of his own premises, his neighbor's cesspool or privy vault may drain into his well and poison his drinking-water. Have the house upon a place high enough, and as dry as possible. Avoid, whenever practicable, narrow streets, which are devoid of sufficient sunlight and pure air. The width of the street should be twice the height of the houses along

it, and no street, even in the business centres of cities, should be narrower than the height of the houses. In many of the older cities, however, the streets are narrower than this.

The best soils upon which to build are gravel, marl, and limestone; for in these the drainage is likely to be better than in others.

A due amount of shade around the home renders it more healthy, but the shade should not be dense enough or close enough to the house to obstruct the air and light.

THE CELLAR.

Every dwelling-house, even that which has but one room in it, should either have a cellar, or should be raised sufficiently high from the ground to allow a free supply of air under it. The walls of the cellar should be perfectly water and air tight. It is better, in making the excavation, to remove the earth a foot, on all sides, further than the line on which the outside of the wall will stand; then, after the walls have been built, pack the space with clay or gravel. In this way the walls of the cellar are more likely to be kept dry. If built of brick the walls should be hollow, consisting of a thin outer wall two or three inches from the main wall. The two are firmly held together by occasionally placing a brick across from one to the other as the walls are being built. Unless this is done, moisture will pass through a brick wall, it matters not how thick it may be.

The cellar floor should be of concrete, about six inches thick, and covered with Portland cement or asphalt. If the soil be very damp, tiling should be placed under the cellar floor, and carried out beneath the wall to a larger tile which passes around the house and leads off into some suitable receptacle.

It is absolutely essential to a healthy house, that its cellar should be free from dampness and ground air. In order to secure these requisites, the walls and floor of the cellar must be well built, even if it becomes necessary, on account of increased cost, to deprive the superstructure of some of its ornamentation.

The cellar should be well supplied with light by having windows above ground, or by sunken areas in front of the windows. The window-sashes should be hung on hinges, so that they may be easily opened when the cellar needs an airing.

If the cellar is to be used for several purposes, as the location of the heating apparatus and the storage of fuel and vegetables, it should be divided into compartments, the temperature of which may be kept at different degrees.

Basement bed-rooms are almost universally unhealthy, and should be used only in cases of absolute necessity. It is also best not to have the kitchen in the basement, especially if the room directly above be occupied. If stationary wash-tubs be placed in the basement, they should have a metallic or porcelain lining, and the pipes which conduct the refuse water from them should be thoroughly trapped.

THE WALLS.

If built of brick the walls of the house should be hollow, as described in referring to the walls of the cellar. Furthermore, the plastering should never be placed directly on the brick. The inside of the wall should be "furred," scantling nailed to the furring, and the lathing done as in a frame house. It has been found that a single brick will absorb as much as one pound of water; and if a brick wall be built solid and the plastering placed directly on the brick, the house will be constantly damp. Many of the older brick houses are constructed in this manner, and consequently their interiors always have a damp, musty odor, it matters not how untiring the housekeeper may be in her efforts to have everything sweet and clean.

Even in case of a stone wall, the plastering should not be placed directly on the wall; though stone does not absorb water to any such extent as brick does.

New brick and stone walls are necessarily damp, and for this reason houses built of either should not be occupied until some weeks after the building of the walls. In order for them to dry thoroughly they must be pervious to air; and walls built as recommended above will allow the air to pass through them freely. Plastering does not prevent the air from passing through the walls, but papering does. However, as papering is the most economical way in which walls can be decorated, it will long continue in use. Wall papers containing arsenical colors have been, and are still to some extent, used. Rooms decorated with such papers are not suitable for living apartments. It is generally supposed that only the green colors contain arsenic, but, in truth, it may be present in paper of any color. The only way, then, by which they may be avoided is by having the selected samples tested. Any intelligent druggist or chemist will make the analysis for a small fee, which should be at the expense of the paper-dealer.

A nice way of finishing inside walls is to paint and then varnish them. The varnish prevents the rubbing off of the paint, and places the walls in in such a condition that they may be washed whenever desirable.

THE FLOORS.

Floors should be made tight, so that they may be thoroughly scrubbed with soap and water occasionally. The best floor, from a sanitary view, is one of hard wood, planed smooth, and oiled. It is far better to have a clean, bare floor, than one covered with a filthy carpet. However, where carpets are kept clean, and are occasionally taken up and the floor scrubbed, there is no objection to their use; and it must be admitted that a clean carpet adds much to the comfort of a room. A cheap straw matting is now made, which can be washed when necessary, and it will not retain dust and filth to the extent that woollen carpets do. Such a covering is especially suitable for dining-rooms.

ARRANGEMENT OF ROOMS.

The living-rooms should be on the sunny, airy side of the house. Human beings as well as plants demand sunlight. Too frequently the good housewife shuts out the sunlight for fear that it will fade the carpet. As some one has said, "It is far better to have faded carpets than to have faded cheeks." A little saving in the color of the carpet is poor economy when it is secured at the cost of health. Especially should the room occupied by the women and children, who are indoors much of the time, be well supplied with light. If there is to be a long, dark hall or passage-way in the house, let it be on the side upon which the least sunlight falls, and place the living-rooms on the other side.

It is, unfortunately, the fashion to make bed-rooms small in order to have a large sitting-room. Too often the bed-room is a mere recess scantily supplied with fresh air. It is better to have a smaller sitting-room and a larger bed-room. Even farmers often suffer from diseases which are due to an insufficient supply of pure air. This arises from the fact that for six or seven hours out of every twenty-four they are shut up in small, tight, musty bed-rooms, and are compelled to rebreathe the air which they have already once breathed.

As has been said in discussing the cellar, basement bed-rooms are always poorly supplied with fresh air, and are generally damp and musty. They should be used only in cases of absolute necessity. Attic bed-rooms are cold in winter and hot in summer, and their use also can be excused only on the question of dire necessity.

If the owner of the house can afford it, at least one bed-room should contain a grate or fire-place.—for, with every attention to the laws of health, there will come times when some member of the family will be sick; and the sick-room should be full of cheer. The open fire is cheerful, and serves as an excellent ventilator. Pleasant surroundings often aid the doctor's pills and potions in restoring the patient to health.

Of course the number and exact arrangement of the rooms will depend upon the purse of the owner; but a cottage may be built so as to be as healthy as a palace,—and indeed the advantage is often in favor of the former, as the more complicated finishings and elaborate furnishings of the latter may serve as harbors for dust and filth.

Space may often be saved by doing away with the conventional long, dark hall, and by having the stairs go up from a sitting-room or from a smaller vestibule. The long halls are often cold, dark, and dreary. In winter they are filled with cold draughts, and in summer they are receptacles of refuse of various kinds, and at all times they are cheerless. They may be necessary in certain houses, but in small homes they are neither ornamental nor pleasant.

It is the ambition of most American housewives to have a parlor, in which the most valuable household ornaments are placed, and which opens only when some honored guest comes. The small boys of the family look upon it as forbidden territory, and too frequently both fresh

air and sunlight are regarded as intruders, and are shut out. The exclusion of the small boy may be all right, but the air and sunlight should not be treated with so much discourtesy. Indeed, they should be considered the most honored guests, and should be welcomed even to a place in the parlor.

Probably the most important room in the house is the kitchen. Before you praise the housekeeping of any woman, visit her kitchen. The parlor may be a beauty, the bed linen may be spotless, the table may be covered with decorated china, but if the kitchen be filthy, all is in vain. But in order that the kitchen may be kept in good condition, its construction must be proper. The floor is best of hard wood or yellow pine; or, if these are too expensive, of selected white pine. They should be kept bare.

At least two windows, one on each side, are desirable. A pantry or shelves for setting aside clean cooking utensils and dishes should be at hand. If the cellar be used for the storage of vegetables, an inside stairway from the kitchen or pantry should lead down into it. The flour-box in the pantry should be so hung that it will close itself. It adds much to the comfort of the cook, and to the cleanliness of the walls and ceiling of the room, if the stove or range be covered by a hood which conducts the vapors arising from the cooking food into a flue in the chimney.

If the owner can possibly afford it, the house should contain a bathroom. In the absence of public water-supply, a force-pump below, a cold-water tank in the attic, and a hot-water tank attached to the kitchen range will furnish the bath-tub. The room should be heated either directly or from another room, otherwise it would not be used much in cold weather. The cost of the bath-room and its supply need not be great, while the pleasure and benefit derived from its use will be appreciated.

THE WINDOWS.

The importance of an abundant supply of sunlight has already been insisted upon. If possible, every room should have direct light, and not be dependent upon that which is diffused through an adjoining room. The location of the windows should be such as to give the greatest amount of direct sunlight. The windows should extend well towards the ceiling, and should be hung so as to lower from the top as well as raise from the bottom.

The window shutters or blinds must be hung in such a manner that they are easily opened. In no part of the house should they be kept closed during the day.

HEATING AND VENTILATION.

It would be wholly out of place to attempt here any elaborate discussion of the many methods of heating and ventilating buildings now in use. Only a few practical statements will be made with reference to securing adequate warmth and sufficient fresh air in dwellings.

The most common methods of heating small residences are by the stove, open fire, and hot-air furnaces. The stove is the most economical. The open fire is the most enjoyable, and where it is sufficient, the most healthy; but in the Northern states the open fire alone seldom furnishes enough heat during the coldest months. The hot-air furnace may be so constructed as to be a good method, but care must be used in selecting the furnace and arranging for ventilation.

In small houses the heat is generally supplied by stoves. In rooms which are occupied only during a few hours of the day the wood stove is sufficient, and, indeed, has certain advantages. The room can be quickly heated, and when left, the fire soon dies out, thus saving fuel. But where the room is constantly occupied, coal is a more suitable fuel than wood. The temperature is more even, and the fire burns more slowly. The relative cost of these fuels varies in different sections.

The coal stove should have no loose joints through which gases can escape. The mica doors should be kept in repair, and the flue must not be allowed to clog. The principal gases given off from burning coal are carbonic acid gas, carbonic oxide, and sulphurous oxides. The carbonic oxide is poisonous when inhaled in any quantity. It produces a sensation in the head similar to that which would be caused by a tight band; and in larger amounts it renders persons insensible, and may produce death. It should be remembered that the carbonic oxide is without odor. Whole families have been fatally poisoned with it. Especial care must be taken with coal stoves which are used in bed-rooms or in rooms which communicate with bed-rooms, as the carbonic oxide may prove fatal to persons while sleeping, without waking them. But there is no danger if the stove and flue be in proper condition. Makers of wrought iron stoves and furnaces will insist that these gases pass readily through cast iron, and for this reason their stoves are superior, and free from danger; but a properly constructed and properly managed cast iron stove or furnace is free from danger, and in many respects is superior to those made of wrought iron. Especial attention should be paid to the position of dampers in coal stoves at night.

One of the greatest objections to the use of stoves is, that in houses in which they are used there is generally no attempt at ventilation. However, a house heated with stoves may be as well ventilated as any other. In houses as ordinarily built, much fresh air will come in through the crevices around the doors, windows, and baseboards. But if many occupy the room, the amount of fresh air which finds admittance through these channels may be insufficient: especially is this likely to be the case if the room is partly surrounded by other parts of the building, and consequently has but a small surface directly exposed to the out-door air. Besides, the direct draughts from doors and windows may be so great as seriously to affect the health of the inmates, giving them colds. When any of these troubles exist, one of several simple devices may be resorted to in order to secure the admission of plenty of fresh air without dangerous draughts. The most common of these devices consists in fitting a

piece of board from four to eight inches wide in the window frame under the lower sash. By this means a space is left between the bottom of the upper and the top of the lower sash, through which the air enters, and the current is thrown upward, striking the ceiling, from which it is diffused all over the room. Dr. Keen recommends tacking a piece of cloth across the lower eight or ten inches of the window frame, then raising the lower sash to a greater or less extent, according to the weather. In this way two air vents in the window are established, one under the lower sash, the current of which is turned upward by the cloth, and the other between the upper and lower sash, as when the board is used. Through the upper vent it is supposed that some of the foul air will escape, though the current through this opening is not invariably outward.

What is known as Maine's elbow-tube ventilator consists of a board placed under a raised sash, as already described. This board carries two tubes, about six inches in diameter, which turn upward, and the ends of which are supplied with valves by which the amount of in-flowing air can be regulated.

Another method provides for smaller tubes brought through the wall and turned upwards into the room. Some favor still another plan, which consists in bringing a tube about six inches in diameter through the wall, and, possibly, under the floor to the stove, where the tube terminates in a sheet-iron jacket placed around the stove, leaving a space of one or two inches, and having escapes only at the top of the jacket. The heat of the stove will produce a strong current through the pipe, and the incoming air will be warmed in passing through the jacket.

By any of the above mentioned devices, abundant facility may be furnished for the admission of fresh air; but as two bodies cannot occupy the same space at the same time, there must be provided some escape for the foul air. This should always be attended to in the construction of the house. For every room which is to be heated by a stove, there should be two flues, one for the smoke and other gaseous productions of combustion, the other for the removal of foul air from the room. The ventilating flue must come to the floor, just above which should be a register. When there is a fire in the stove, the upper part of the ventilating flue will be warmed by the smoke flue, and consequently there will be an upward current in it. In this way the withdrawal of the foul air is rendered certain. It should also be seen, in the construction of the chimney, that the inside of this ventilating flue is not left so rough as to impede the flow of air through it, and that it is not clogged with mortar or pieces of brick. A good draught through the ventilating flue is almost of as much importance as the draught of the smoke flue.

The partition between the smoke and ventilating flues should be of brick placed on edge, thus making it as thin as possible, so that the upper part of the ventilating flue will be thoroughly heated from the smoke flue. By another method the smoke flue may be made of iron pipe placed in a large flue, and the space all around the pipe will serve as the ventilating flue. I have stated that the register in the ventilating

flue should be near the floor. If near the ceiling, as some would have it, there would be too great a loss of heat, as the fresh air as soon as heated would find its exit. For summer ventilation, the foul air outlet may be at or near the ceiling; but such ventilation in winter costs too much, and, besides, when it is used, great difficulty will often be experienced in heating the room.

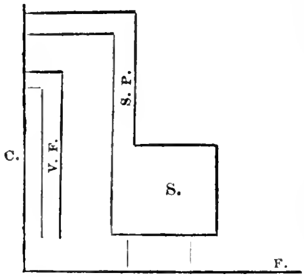


Fig. 1.—F., floor; S., stove; S. P., stove pipe; V. F., ventilating flue; C., chimney.

With the plan recommended above, there is no reason why any room heated with a stove may not be so well ventilated that no disagreeable odor will be perceptible to the most sensitive person upon coming in from the outdoor air; provided, always, that the room is clean. Unfortunately, however, the great majority of houses which are heated by stoves are built without the slightest provision for ventilation. In such houses, fresh air may be introduced according to the methods already given; but the escape of the foul air is more difficult to be provided for. It may be done, however, as follows: Place a tin or sheet iron pipe, of from six to ten inches in diameter, according to the size of the room, along the wall behind the stove. The lower end of this pipe extends to within a few inches of the floor, and remains open, while the upper end passes, by means of an elbow, into the smoke flue below the point at which the stove pipe enters, as shown in the accompanying Fig 1. The upper end of the ventilating flue may, when the chimney begins near the ceiling, terminate in a jacket around the stove pipe, the jacket passing into the chimney as here shown in Fig. 2. In all cases the ventilating flue is to have air-tight joints.

With the open fire or grate, the withdrawal of the foul air is all provided for, as it will escape up the chimney. The open fire is not so economical as the stove; but, when sufficient to warm the room, the former is, at least as both are ordinarily arranged, more healthful. With the open fire or grate, much of the heat escapes up the chimney; however, with the grate this loss of heat can be, to a considerable extent, lessened by setting the fire-basket well forward.

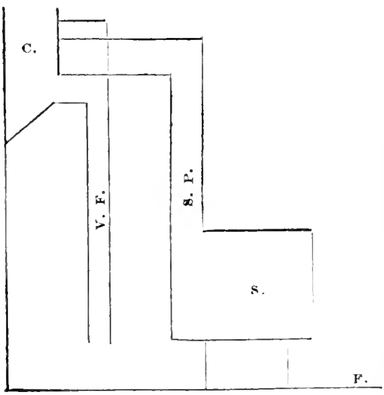


Fig. 2.

When the hot-air furnace is used, certain precautions are desirable, both for economy and health. In the first place, the furnace selected is nearly always too small for the extent of heating required of it. When this is the case, the fire must be pushed as much as possible in order to keep the rooms warm in winter; consequently the air entering the room is over-

heated, and produces headache and dulness. At the same time the furnace is soon burnt out, and any money saved in the first place by purchasing the smaller size will have to be expended with an additional amount in securing a new furnace.

The furnace should be thoroughly encased with thick brick walls, to prevent great loss of heat by direct radiation in the cellar. The owner of the house will be rewarded for his time and trouble if he sees to it that this work is well done.

The furnace must receive the air which is to be heated directly from the out-door air, and not from the cellar. The cold-air duct should be perfectly air-tight, so as wholly to prevent the cellar air from entering the heating chamber. Wooden air-boxes are not to be recommended unless they be carefully lined with some metal. The external opening of the cold air box should not be near any cesspool, drain, or other possible source of deleterious gases. It should also be protected by a piece of wire net. In the cold-air duct, preferably near its external opening, should be a sliding valve, by which the amount of air passing to the furnace can be regulated; but care must be taken that this valve is never entirely closed. Probably it would be better to have it made so that when pushed in as far as possible it will obstruct only half the area of the duct.

The air chamber in the furnace should be kept supplied with water. The hot-air flue should be so arranged that the horizontal ones are not more than fourteen or sixteen feet in length, for if the horizontal flues be much longer than this, the draught through them will be so slight that the rooms will not be warmed, while the rooms supplied with vertical pipes will be over-heated.

The warm-air register in the room should not be placed directly in the floor, but in the base-board. If placed in the floor, it soon receives a large amount of dust and other refuse.

With a hot-air furnace properly selected and arranged, the amount of warm, fresh air entering the room is sufficient. But before the fresh, warm air can enter, the air already present must find an exit. The following principles may guide us in economically ventilating a room heated with a hot-air furnace:

(1) Bring the fresh air in near the floor.

(2) Take the foul air out near the floor.

(3) Create a draught in the foul-air shaft by means of heat.

Unless the air already in the room has some means of exit, it will be found utterly impossible to heat the room with the warm-air furnace. Then it will be seen that both the heating and ventilation depend largely upon the withdrawal of the foul air. If the foul air register be near the ceiling, much of the warm air from the furnace will escape directly into the foul-air shaft. If there be an open fire in the room, the foul air will find a ready exit through the chimney. If there be only a ventilating flue, it should be in the same chimney with some other flue which is heated, at least in its upper half. Thus a number of ventilating flues

from as many rooms may be placed in the same chimney with, and arranged about, the smoke flue of the furnace. Often we find that one ventilating flue is expected to do service for a room on the first floor, and also for another directly over it on the second. The result frequently is, that the foul air of the lower room passes into the room above. There should be a separate ventilating flue for each room.

WATER-SUPPLY.

It is of the greatest importance to the family that its supply of drinking-water be of unquestionable purity. That such dreaded diseases as cholera, typhoid fever, scarlet fever, diphtheria, and dysentery may be spread by impure drinking-water, there can now be no question.

The sources of drinking-water may be divided into the following classes:

(1) Cistern water.
(2) Surface water.
(3) Subterranean water.

Cistern water is that which is collected upon the roof of a house, and stored in a reservoir known as a cistern, or in a tank, which is usually placed in the attic of the house. Cisterns, or underground reservoirs, are more generally used than tanks.

The condition of this kind of water will be influenced by the air through which it falls, by the nature of the roof, and by the kind of cistern, and the care exercised in keeping the roof and cistern clean.

In large cities, especially where there is much manufacturing done, there is always a considerable amount of dust and other impurities in the air, much of which is brought down with the rains. The conductors leading from the roof to the cistern should be supplied with means for turning off the first part of the rain-fall. In this way the impurities taken from the air and those collected on the roof are disposed of. Especially is this desirable if the roof be of wood and old, if there be a collection of leaves and other *débris* from projecting branches of trees, and if there be any chance of birds depositing their excrement upon the roof. Probably the cleanest roofing material is slate; but its cost has prevented its general use in the construction of residences.

The cistern should be built of brick, and plastered water-tight upon the *outside* as well as upon the inside. Strict attention should be paid to this, and the walls should be so built as to prevent the possibility of water from the adjacent soil passing into the cistern.

The top of the cistern should be well covered, so as to prevent small animals as well as vegetable refuse from falling in. The best covering would be a box built up several feet above the ground, and covered with fine wire netting. In this way the fresh air will pass down, and the space above the surface of the water will be ventilated. When this cannot be used, a tight covering of stone, or of wood, if all boards are removed and replaced by new ones at the first sign of decay, may be used.

A wooden pump should not be placed in the cistern, as it soon decays, becomes covered with moss, and collects upon it much filth. An iron pipe with the pump in the kitchen is probably the best arrangement. However, the cistern should never be built under the house. When so built the air above the water is invariably bad, and the periodical cleaning out of the cistern, which should be done once a year at least, is not so likely to be attended to.

It is customary in some places to place near the top of the cistern an over-flow pipe which leads into a cesspool or privy-vault. This practice has, without doubt, cost many lives. There should not under any circumstances be any connection between the cistern and any receptacle of filth. This over-flow pipe is often untrapped, or the trap becomes defective, and the gases arising from the decomposing matter of the cesspool and privy-vault pass into the cistern. Indeed, cases are known where not only the gas, but fluid refuse, has thus been poured into the cistern.

However much care may be taken with the cistern,—and the above suggestions should be deemed of imperative importance,—the cistern water should be filtered before used. Many cheap and effective household filters are made, and it is not necessary to go into detail concerning their construction; but a few practical hints may be given as to their care. A filter which is kept constantly under water soon becomes utterly worthless. The charcoal box should be frequently exposed to air, and, if possible, to direct sunlight. A filter removes suspended matter, and, on account of the air condensed in the pores of the charcoal, destroys to a certain extent the organic matter held in solution in the water. If any epidemic disease prevail at the time, it is always safest to boil any and all water used for drinking purposes. Cistern water may be boiled and then filtered. If one has no regular filter, it will be better at all times to boil the water, after which it may be allowed to run through a piece of filter paper, which can be obtained for a trifle at any drug store, placed in a tin or glass funnel. When filter paper is used, a new piece should be placed in the funnel each day.

The purity of surface water will depend on the condition of the soil upon which it falls and over which it flows, as well as upon the air through which it falls. Water which falls upon and flows over a filthy soil should not be used for drinking. Since the amount of refuse on the surface of the earth is usually greater in thickly settled countries, the water collected on such sheds is unfit for use. That there is a certain degree of purification in running streams there can be no doubt; but notwithstanding this, specific poisons have been carried long distances in rivers, and have still manifested their poisonous effects.

When any serious epidemic prevails, and surface water constitutes the drinking supply, it should always be boiled. In India, the spread of cholera is often along the water-courses into which excrement from the sick and the bodies of the dead are often cast. Typhoid fever and dysentery are also often spread by the use of surface water.

The water collected in shallow wells is really surface water, and that often of the worst kind. The use of drinking-water from shallow wells is, as a rule, to be condemned. Many people think if water percolates through a few feet of soil, every harmful substance is removed. No greater mistake could possibly be made. Indeed, by percolation through the soil, the impurity of the water is often increased. Various kinds of filth which have accumulated upon and within the soil are dissolved in the water and carried into the well. Often we find in a small back yard a cesspool, privy-vault, and well, all in close proximity. If the well be a shallow one, such an arrangement is probably the worst, in a sanitary sense, that could possibly be devised.

Subterranean waters used for drinking purposes are those obtained from springs and deep wells. Whether such waters are pure or not depends largely upon the geological formations in which they exist. The source of the water must be below rock or thick clay beds in order for the water to escape surface contaminations. Springs from gravel hills may be as impure as shallow wells. A very small amount of iron in water does not render it unfit for drinking; but water which contains more than one tenth of one per cent. of iron is unfit for constant use.

Deep wells should have their walls so protected as not to permit of surface water finding its way through them. If this is not the case, their waters may become quite as foul as those of shallow wells.

Subterranean waters are often hard. By this is meant that they fail to make a lather with soap, or a large amount of soap must be used with them in order to produce a lather. The hardness of water is due to the presence of certain inorganic salts, as those of lime and magnesia, which form insoluble compounds with soap. Hard waters are divided into two classes:

(1) Those whose hardness is removed by boiling. This is known as temporary hardness.

(2) Those whose hardness is not removed by boiling. This is known as permanent hardness.

Many waters possess both a temporary and permanent hardness. Such waters are improved by boiling, but are not rendered wholly soft.

Hard waters are not suitable for laundry purposes, especially when the hardness is largely permanent. They also often form incrustations in boilers. But unless the hardness be very great, it does not unfit the water for drinking purposes. There has been much discussion as to the possibility of hard waters producing goitre. It is well known that this disease is very prevalent in certain limestone districts; but that the use of hard water for drinking is the cause of the disease has not been positively demonstrated. It would be best, however, for families in which a tendency to goitre prevails to use soft water.

Hard water has also been supposed to favor the formation of gravel. The writer has met with a few persons who are troubled with gravel only when using hard water.

Some hard waters have an irritating effect upon the bowels of those not accustomed to their use, producing in such persons diarrhœas.

In case of the use of a public water-supply, it is the duty of the health authorities of the city to see that the water is wholesome, and it is the duty of the consumer to see that the water is not contaminated on his premises. Lead pipes and lead lined storage tanks should not be used for conveying or storing cistern water. The pipes should be of iron, or better still, of block tin, or should be lined with tin.

THE DISPOSAL OF WASTE.

One of the most important questions connected with modern sanitation is as to the best methods of disposing of waste matter. When allowed to accumulate in the vicinity of homes, it may poison both the water and the air. Many of the older cities of southern Europe have become thoroughly saturated with filth, and for this reason cholera has found a fertile field for its growth in Spain, Italy, and southern France. Filth and disease always go hand in hand, the former leading the latter. Cleanliness invariably lessens the death-rate. Typhoid fever, cholera, and other diseases, whose growth and spread are plainly due to the accumulation and putrefaction of waste matter, should be stamped out of existence. With perfect cleanliness they would not be known.

It is the writer's object to give here some practical suggestions for the disposal of waste matter. Probably the disposal of human excrement deserves more care than any other waste. In cities where there is an abundant public supply of water, and where sewers are in use, the water-closet is the most convenient method, and it may be made perfectly safe. Where water-closets are used, the so-called "separate system" of sewerage is desirable. This system provides two sets of sewer conductors. One of these is the ordinary brick sewer, and this system is used only for carrying off the storm-water. The other is made of small sewer pipes which convey the sewage proper, and which are connected with flushing tanks, by means of which they are periodically flooded with water and washed clean. The advantage of this method is easily understood. When the single system is used, the sewers are necessarily large, in order to carry off the great amount of rain-water. The bottom and sides of these sewers must be more or less rough, and they are flushed only at the time of heavy rain-falls; consequently much of the time the flow of sewage through them is slow, and the solid matter is deposited on the rough surfaces, where it decomposes with the formation of noxious gases, which escape through ventilators into the street, or pass through defective traps into the houses.

With the separate system the small sewer pipes with smooth inner surfaces are flushed three or four times a day, and their contents are swept out. It requires twenty-four hours at least for human excreta to decompose to such an extent as to evolve poisonous gases; therefore, if the pipes be flushed clean one or more times during the day, there can be but little danger from "sewer gas."

However, whichever system of sewerage is in use, the individual should take certain precautions in arranging his water-closets. In the first place, water-closets should not be placed in living-rooms or in bed-rooms. They should be located if possible in some detached part of the house. The kind of closet selected should be determined upon by some competent person. Changes and improvements in the patterns are being constantly made, so that should any preference be given at this time it might not hold good three months hence. The flushing tank for the water-closet should not in any way be connected with the drinking water-supply. The closet should be well trapped, and the trap should be so placed that it can be examined at any time without tearing up the floor or breaking into the wall. The habit which plumbers have of hiding all their work should be condemned. The soil pipe should not be connected at any point inside of the house, at least with the other waste pipes, such as those from the bath-tub and stationary wash-bowls. The soil pipe should be ventilated by a pipe which should be as nearly perpendicular as possible, and which should extend above the roof of the house, and should not be placed near a window. This ventilation of the soil pipe is of the utmost importance, and should never be neglected.

When there is no system of sewerage, the dry-earth closet is the best method of disposing of human excrement. Indeed, upon sanitary grounds the dry-earth system is in many respects more desirable than the use of water-closets; but the former requires possibly more care than the latter. Economically, also, the dry-earth system will prove the better when it comes into more general use, and the excrement is used as a fertilizer. A dry-earth closet properly kept is free from all noxious gases, and there is no possibility of the drinking water-supply becoming contaminated from it.

There are many patterns of dry-earth closets in use, but the simplest may be made as efficient as the most complicated and costly. A cheap form is made by placing under the seat boxes or drawers lined with galvanized iron. There is placed conveniently a quantity of dry earth, and for each evacuation a small shovel of the earth, from one to two pounds, is thrown in. When the drawers are full they are removed, emptied, and replaced. The best earth to use is pulverized clay mixed with about one third its weight of loam. Ordinary garden soil may be used, if dried perfectly. Sifted coal ashes are almost or quite as good as any earth. Moreover, they are generally on hand, and to be disposed of in some way. The writer has used for his family a dry-earth closet for three years, and prefers the sifted coal ashes to any kind of earth. Gravel is not at all suitable.

With an ordinary family with not more than half a dozen members it is not necessary to empty the boxes more than once in three or four weeks. Their contents, which if enough soil or ashes has been added, is wholly inodorous, and may be emptied upon the garden. Here it is spaded in during the spring, and as a fertilizer amply repays for the time and trouble that has been taken with it. Several large cities in Europe

have adopted the dry-earth system, and the waste is removed by those who desire to use it as a fertilizer.

The patent earth-closets are so arranged that the requisite amount of earth falls into the box in a manner similar to that by which the water-closet is flushed with water.

In case epidemics of any kind are prevailing in the neighborhood, it would be well to throw a handful of chloride of lime into the closet each day. And even when no epidemic prevails, but the weather is very hot, the same quantity of sulphate of iron (copperas) may be used daily. The cost of this substance is so small that it may be used freely when needed. Where many are using the closet, a vault may be dug beneath the seat, and made water-tight with brick and cement. Into this should be thrown each day a sufficient quantity of this dry earth, and the vault should be thoroughly cleaned at least once a month.

The ordinary privy-vault with porous walls is an abomination. It has caused more deaths in this country than war and famine have produced. The liquid poisons from it filter into wells, while its gaseous exhalations float through the air. People breathe and drink their own excretions, and typhoid fever and kindred diseases slay tens of thousands annually. It is safe to say that the privy-vault is the origin of the majority of the cases of typhoid fever. As the country becomes more thickly settled, the dangers from the privy-vault increase, and they should be wholly abandoned.

In many places it is the custom to move the privy, and cover the contents of the vault with a few shovels of dirt as soon as the vault is filled. In this way from one to half a dozen repositories of filth are formed in the average village back yard in a few years. Such a condition is certainly a highly unsanitary one.

The waste-pipes from the bath-tub and stationary wash-bowls should be well trapped, with the traps where they can be readily examined; and, as has been stated, these waste-pipes should have no connection, inside of the house at least, with the pipe from the water-closet. In the absence of sewage, the waste-pipes from the bath and bowls may be conducted into a cesspool. If the soil be gravelly, this cesspool should be lower than the bottom of the cistern, if the cistern be near. Its walls may be of stone or brick loosely laid, and a ventilating pipe should pass from the top of the cesspool, and extend at least ten feet above the surface. No kitchen or laundry waste should be allowed to pass into this cesspool. Since the water passing into this cesspool comes only from the bath and wash-bowls, it does not contain a great deal of organic matter, and will pass into the soil. The cesspool for the kitchen slops should be walled up and made water-tight. This cesspool should also be ventilated by means of a large vertical pipe. The top of this cesspool should have a man-hole in its centre, covered with a stone or iron slab, which can be removed in order to clean out the cesspool.

It is better for all pipes leading to sewers or cesspools to be disconnected, or furnished with gulley traps or with an air pipe just outside of

the house, in order to prevent the possibility of gas passing from the sewer or cesspool into the house. All cesspools should be as far from the house as possible, and they should be cleaned at regular intervals. The contents of the kitchen cesspool may be used for fertilizing.

All solid kitchen waste should be removed daily by a scavenger, who does this without expense to the householder, or it may be dried under the kitchen stove in shallow pans and then burned in the kitchen fire, or, if in the country, it may be fed to hogs or other animals.

The dust swept from the floor should be burned, not thrown out into the yard. Ashes should be kept in a dry place, and if so kept they may often be disposed of without cost. The soap-maker will pay for dry wood ashes, and coal ashes are often sought for and used for filling in low places. Each fire-place and grate should be furnished with an ash-pit in which the winter's product may fall, and by which accident from fire is greatly lessened.

When a house is built, a plan of all its drainage pipes should be made and preserved, as with it a faulty pipe or joint may often be found with ease, when without it much work may be necessary in order to find where the trouble is.

THE SURROUNDINGS.

It would be better if residences were not built up in solid blocks. Even narrow passage-ways between the houses, through which the air can move freely, are to be preferred to unbroken blocks. However, the price of land and of building material may compel some in the larger cities to deny themselves any further separation from their neighbor than that afforded by a single brick wall. But under no consideration should residences be built back to back, without any open space between the kitchens of the two houses. Even a few feet of open yard are of great benefit in affording ventilation, and in preventing excessive dampness. The yard should be kept scrupulously clean, and it should be rendered as beautiful as circumstances will permit. In summer there is no place for children in their play preferable to a nice spot out of doors.

The arrangement of cesspools, wells, cisterns, and out-houses has already been discussed. None of these should be allowed to contaminate the soil or air of the yard. Trees not too dense or too near the house are beneficial in shutting off dust, and tempering the heat of the summer's sun. Besides, no other ornament about the premises can be more attractive than beautiful trees.

The location of all the out-houses of the immediate neighbors, as well as those directly on the premises, should be taken into consideration. The yard should be so graded that the surface water will not collect about the foundations of the house.

A little care and a trifling expense in the surroundings will amply repay any family, and will increase one's love for what should be the dearest spot on earth—home.

THE CARE OF THE HOME.

Suppose that a location has been selected, a house built, and the surroundings prepared according to the foregoing directions, the next thing is to see that all is kept in a sanitary condition. Some families would convert the most scientifically constructed house into a den of filth. Cleanliness should be the watchword of every family. So far as sanitary needs are concerned, all the directions under this head might be condensed into the few words, "Keep everything clean."

Decaying vegetables must not be left in the cellar. Fresh air is to be admitted daily into every part of the house, from cellar to garret. Bedrooms especially are to be thoroughly aired. Refuse bits of food are not to be left to mold on the pantry shelf, nor should they be thrown out into the back yard. Better burn them. Offal from the preparation of food is not to be allowed to remain in the house, nor is it to be thrown out. It must be placed in the swill barrel, or burned. Dirty dishes are not to go unwashed, nor filthy floors unscrubbed, nor soiled linen unlaundered.

Fresh meat, milk, and other foods are not to be allowed to remain uncovered in living-rooms or bed-rooms. The flour-box is to be kept free, not only from the ravages of rats and mice, but from the dust of the room.

The drain from the ice-box should not be allowed to pass into a cesspool, sewer, or soil-pipe. Indeed, there should be no kind of connection between the ice-box, or other place in which food is kept, and any receptacle of waste matter.

The floors and seats of water-closets and earth-closets are to be kept clean. Drains and cesspools must be attended to. The supply of drinking-water must be kept free from every contamination.

Continued health is the reward for the care bestowed upon these details. The labor brings a rich return.

BUYING OR RENTING A HOUSE.

Great care should be exercised in renting or buying a house for family occupation. Many houses are now built purposely to rent or sell, and too many of these are constructed in a very flimsy manner. The object of the builder is to attract attention to his house, and money is spent in ornamentation, which should have been used in the more important parts of the structure. No one should place his family in a house until he has made a thorough investigation of its sanitary condition. The mere advertisement that "the house is furnished with the most approved sanitary appliances" should not be considered as a sufficient guaranty. Indeed, the statement of the owner or agent, that "everything is all right," is usually not to be relied on. The time will come when no one will be permitted to rent a death-trap in the shape of a house; but, unfortunately at present, the duty of seeing that everything is really all right devolves

upon the person seeking a house. For this reason a few practical directions for house inspection may not be out of place here. The writer has known a man, even after having been warned by a former tenant, who placed his family in a house whose sole recommendation was its attractive appearance, and to regret his rashness a few weeks later when typhoid fever had stricken his family. The dangers to health and life are too great to allow any one to be careless or indifferent in this matter.

The house offered for rent or sale should be visited by the one seeking a home, and thoroughly inspected in regard to its sanitary condition, as well as to its general appearance. The surroundings should be studied. The condition of the back yard,—especially the location of out-houses on the premises and those of the neighbors,—the location and condition of cesspools, privy-vaults, cisterns, or wells, if such be present, should undergo careful inspection. What the sanitary arrangements should be has been already sufficiently indicated.

The cellar should be visited, and if its walls be cracked, damp, and covered with mold, if water stands upon its floor, and if light and ventilation are not provided for, seek some other habitation. It is better far to sleep in the open air, with no roof but the sky and no bed but a few blankets placed on the dry earth, than to live in a house built over a reeking cesspool; and such a cellar is nothing more nor less than a cesspool.

The general construction of the house should be closely scrutinized. Observe the height of the first floor above the level of the street, the proportion of the lot covered by the house, the arrangement and size of the rooms, and the condition of the floors, ceilings, and walls. Of course newly constructed walls are always damp. A great amount of water is used in the mortar and plastering, and much of this must evaporate before the building is fit for occupation. Neither should a house freshly painted with lead paints be occupied until the paint is well dried. The living-rooms should be placed upon the sunny, airy side of the house. The bed-rooms especially should be examined with reference to their size and means of ventilation. The floors should be of seasoned wood, well jointed. This is very desirable, as it prevents the accumulation of dirt under the floors, and permits of the free use of water in scrubbing the upper floors without danger of injury to the ceilings of the lower rooms.

"Skin" houses, put up by "jerry" builders simply to rent or sell at the highest price, can usually be recognized by careful inspection. Extra ornamentation will generally be observed, but, if a few months have elapsed since its construction, doors will be noticed not to close tightly, the wood-work is shrunken, the window-sashes do not move easily, and too frequently the foundations have settled and the walls cracked.

If the house be furnished with any plumbing, this should undergo thorough inspection. A map showing the distribution of the pipes, unless all are in plain view, should be furnished by the owner. In many old houses large brick drains are found in the cellar. These are always

bad. In them a great quantity of filth accumulates. They are seldom sufficiently flushed. Such a condition should lead one to reject a house for residence. If the drain in the cellar be of earthen pipe, its joints should be examined, for they are often imperfect, and allow of the escape of both gaseous and liquid contents. In this way the cellar floor becomes impregnated with filth, and from it noxious exhalations rise into the rooms above. The writer has known of more than one instance in which one of these drains has been broken by settling, and the consequence was that a regular cesspool was formed instead of the drain. In one instance the break occurred near a cistern, and much of the chamber and kitchen slops soaked through the imperfect cistern, polluting the water; and this was the probable cause of the typhoid fever which attacked four of the inmates of the house. Still worse is the box drain made of plank. Often at the junction of the vertical pipe with such a drain, the wood decays, and a filthy cesspool is formed.

Unfortunately in most cities the sewers pass along the street in front of the house, and the sewage is collected in the back part of the cellar, and carried by a drain under the floor for the entire length of the cellar, passing out under the front wall on its way to the sewer. The best place for the sewer is in the rear of the house, but when in front, the drain should be carried around the house; or, if through the cellar, it should consist of an iron pipe freely exposed along its entire length, and with sufficient fall to give a rapid current. Its grade should be uniform, and free from depressions in which accumulations might occur.

The proper arrangement of the soil pipe has already been referred to. It should be of iron, not of lead. Leaden soil-pipes are often corroded and leaky. The ventilation of the soil-pipe should be by means of a pipe extending above the roof. The water conductor from the roof should not be made to do service as a ventilating pipe. Moreover, when the rain-water conductor empties into the soil-pipe the force of the current through it will siphon the traps above unless they are all ventilated.

The location of all traps should be ascertained, and it should be seen that none of the pipes are either clogged or leaky. The desirability of the separation of the water-closet from the bath and wash-bowls has already been referred to. It is not desirable to have even stationary wash-bowls in bed-rooms.

If there be a water-supply, it is well to see, before renting or buying the house, that all the pipes are in good order and so protected that they will not freeze. If the drinking-water be stored in a tank, see that the tank is not lined with lead. All water pipes should be well supported, or they may sag and break.

The inspection of the method of heating and ventilating the building may be made from the rules in regard to these points already given. The same is true in regard to the disposal of garbage and the construction of earth-closets.

TENEMENT-HOUSES.

Every working-man should strive to secure a home, and the tenement-house can never be a home in any proper sense. The privacy and comfort of a home can never be secured in a tenement-house. Here people of all kinds are congregated, and the noise of the boisterous will disturb the rest of the quiet; the filth of the slovenly is likely to injure the health of those who endeavor to keep everything about them clean; and the habits of the immoral are distasteful to the moral. However, on account of poverty, many good people are compelled, for a time at least, to occupy rooms in a tenement-house. Unfortunately, the majority of such houses are built for the purpose of making as large pecuniary return to the owner as possible, and he cares but little about the character of his tenants or the manner in which they live, so long as their rent is paid. In the large tenement-houses of New York, all kinds of occupations are carried on, and many of them in the most slovenly manner.

The tenement should have a cellar under every part of it. The cellar should be divided into compartments by brick walls. No part of it should be used for sleeping-rooms, and it should be perfectly dry and well ventilated. The walls and floors throughout the building should be deadened. The halls should be lighted at both ends. They should be wide, and the space should not be encroached upon by using them as storage rooms.

Each water-closet should be thoroughly trapped and ventilated by a pipe extending above the roof. The ends of these pipes should not have return bends, nor be furnished with caps which are likely to obstruct the upward current.

The water-pipes from baths, stationary wash-bowls, laundry tubs, and sinks should have no connection with the water-closets, and should discharge into the open air outside the building over gullies, or should pass through air-traps outside of the house, the air-trap having a large ventilating pipe carried above the roof. In this way there will be no connection between the drain or sewer and the inside of the house, except through the ventilated soil-pipe of a trapped water-closet.

The floor and seat of every water-closet should be scalded with hot water and soap at least twice a week. There should be a separate closet for every fifteen persons.

The laundry work should be done in some special place, and not in the living- or sleeping-rooms. The water-supply should be abundant; and where the water-closets are used, not less than thirty gallons per day for each inmate of the house. Kitchens and bed-rooms should be separate. The minimum amount of cubic space allowed should be five hundred cubic feet per head, and this amount will answer only when ample provision for ventilation exists.

Each room should be lighted by outside windows or by light-shafts. The window sash should lower from the top as well as raise from the bottom. Each room must be furnished with a separate flue for ventila-

tion, or a foul-air shaft, which should be heated. These shafts may be heated by being placed in the same chimney with smoke flues, or in case the entire building is heated by steam, a number of foul-air shafts may be brought together in the attic, and heated by a steam coil. If this is done there should be no means of cutting off the steam from this coil. The method of removing foul air, by means of a large central shaft, may do when there are conductors leading from each room to such a shaft, but when it depends upon the foul air from distant rooms reaching the shaft by means of open doors or through transoms, it will often fail. Moreover, all attempts to ventilate a number of rooms on different floors through the same flue or shaft, it matters not how large it may be, will always prove more or less of a failure; because, on account of difference in temperature, the foul air from one room will often pass into another.

II.

HEALTHY FOODS.

FOODS AND FOOD-STUFFS.

Since particles of our bodies are constantly being worn away and cast out, new material must be introduced in order to make good the loss. Again: it is necessary that our bodies should be supplied with force or energy, that animal heat, muscular movement, and nervous activity may be maintained. For these reasons foods are taken.

Foods may be defined as substances which when taken into the body aid in building up or repairing tissue, or, by being oxidized or burned, generate force or energy.

Our ordinary foods consist of certain food-stuffs or elementary principles, together with a greater or less amount of wholly indigestible substances. Thus, oatmeal is a food containing the food-stuffs, gluten, starch, and fat, with a certain amount of cellulose (cell structure) which is of no service to the body. The nutritive value of a food depends upon the kind and amount of these food-stuffs that it contains. Since no satisfactory discussion of foods can be carried on until we become acquainted with those constituents upon which their values depend, we will briefly consider the food-stuffs. Fortunately they are not numerous, and may be divided into the following classes:

(1) Albumens or proteids.
(2) Fats or oils.
(3) Starches or carbohydrates.
(4) Inorganic salts.
(5) Water.

Albumens or Proteids. To this group belong some of the most important food-stuffs. They all contain nitrogen, and for this reason the term "nitrogenous constituents" is used sometimes instead of proteids or albumens. The chief proteids are ordinary albumen, as the white of egg, casein of milk, fibrine of meat, gluten of grains and flour, and legumine of pease and beans. The amount of proteid in the different foods is variable;—thus, meat contains from 15 to 23 per cent.; milk from 3 to 4; pease and beans from 23 to 27; grains and flours from 8 to 11; bread from 6 to 9; and potatoes and greens from 1 to 4.

When we remember that the blood, muscles, and all the vital organs contain proteids as their chief constituents, we can understand the importance of taking food rich in one or more members of this group. The average working-man requires in his daily food the equivalent of four or five ounces of pure proteid.

The digestive and assimulative organs have the power of converting one proteid into another, but they are not able to form a proteid out of a fat or a starch. For this reason no other food-stuffs can, without injury, be a substitute for the proteids in our food for any length of time.

Fats. Fats when oxidized or burned in the body produce more force than will arise from the combustion of an equal weight of any other food-stuff. In cold countries the inhabitants instinctively consume large amounts of fat on account of the heat which is generated from it. The working-man requires not less than two ounces of fat per day. Fats are best digested when taken in a finely divided state.

Starches or Carbohydrates. To this group belong a number of substances of similar chemical composition, and the majority belong to vegetable foods. The most important are starch, sugar, gum, and dextrine.

Like the fats, they are consumed in giving energy to the body, though a much larger amount of the carbohydrates is required to yield the same result to the body. The daily need of this food-stuff by the average working man is between seventeen and eighteen ounces.

The cellulose or cell structure of plants is closely allied to the members of this group, and any cellulose that is absorbed must first be converted into sugar.

Mineral Salts. The bones of the adult man contain as much as 70 per cent. of mineral matter, the greater part of which is the phosphate of lime. Smaller quantities of the phosphate of magnesium and the carbonate of lime also exist in bones. The muscles, blood, and tissues also contain salts of potash and soda, and some iron. One of the most important mineral foods is common salt or the chloride of sodium.

Water. About 70 per cent. of the adult body is water. It forms the greater part of the vital fluid, in which it serves as the carrier of other substances, some in solution, others held in suspension. Besides the fluids, the solid tissues contain a greater or less proportion of water: the muscles contain as much as 75 per cent. There is also great loss of water by evaporation from the skin, by exhalation from the lungs, and by excretion from the kidneys and bowels. This loss must be made good by the drinking of water, and by taking foods more or less rich in this constituent. Meat contains about 75 per cent.; milk on an average, 87; bread, 35; and vegetables and fruits, from 70 to 90.

THE NUTRITIVE VALUE OF FOODS.

The nutritive value of a food will depend upon the proportion and kind of food-stuffs which it contains. However, there are many conditions which influence the nutritive value of a food. In order for this to be high, its constituents must not only be rich in food-stuffs, but they must be digestible. By improving the digestion, the appearance, odor, and taste of a food increase its nutritive value. A certain method of cooking makes a food more acceptable to one, while another is pleased with a wholly different manner of preparation. The taste and odor, when

pleasing, stimulate the flow of the digestive juices; and not only will more of the food be taken as a result, but a greater proportion of that which is taken will be digested and assimilated.

It is also quite essential that the volume of food taken should be large enough to satisfy the appetite, and still not so great as to prove burdensome. For this reason foods poor in certain food-stuffs are usually taken with some other food rich in these constituents. Thus, the potato, which contains not more than 2 per cent. of proteids, is usually eaten with meat, which contains from 14 to 21 per cent. of proteids; or we may say with equal propriety, that because meat contains no starch, man has learned to take with it the potato, whose chief constituent is starch. If one should attempt to live upon potatoes only, the weight of the food that he would have to take each day in order to get the minimum quantity of proteids upon which life could be sustained would not be less than ten pounds. Dr. Edward Smith actually found some of the poorest Irish laborers confined almost exclusively to potatoes, and consuming the amount given above. This would lead to distention of the digestive organs, and render one dull and stupid. The digestive organs of plant-eating animals form from 15 to 20 per cent. of the entire body weight. In flesh-eating animals the digestive organs form only from 5 to 6 per cent. of the body weight; in man the proportion is from 7 to 8 per cent. Thus, man, upon this point at least, holds an intermediate position between flesh-eating and plant-eating animals, being more closely allied to the former than to the latter. However, as the proper cooking of the food aids digestion, man may digest some of the vegetable food even more quickly and completely than the ox can. But his food should not consist wholly of vegetable products. A certain amount of animal food, while not absolutely necessary to the maintenance of life, is essential to man's highest development.

The nutritive values of the different foods, as shown by the per cent. of the various food-stuffs which they contain, will be given under the special description of each food.

THE ECONOMIC VALUE OF FOODS.

That food is most economical which contains the greatest amount of the most valuable food-stuffs for the least money.

The average working-man requires daily in his food, in round numbers, not less than four ounces of proteids, two ounces of fat, and eighteen ounces of carbohydrates. What combination of foods will furnish these for the least money? This is an important question; but in answering it, it should always be borne in mind that the foods suggested are to be healthy ones. A combination which would cost but little, but which would lead to dyspepsia or other ills, might in the end be quite costly.

The following formulas show some combinations, and give the approximate cost. It will be seen that the required amount, or more, of each food-stuff is present:

Class I.—*Very cheap daily rations without meat.*

No. 1.

	Proteids. Oz.	Fats. Oz.	Carbo-hydrates. Oz.	Cost. Cts.
26 oz. bread	1.82	0.13	14.35	5 at 5 cts. per loaf.
2 oz. oatmeal	0.29	0.12	1.30	½ at 4 cts. per lb.
1 pt. of milk	0.54	0.57	0.76	3 at 6 cts. per qt.
1 oz. sugar			0.94	½ at 8 cts. per lb.
24 oz. potatoes	0.48		4.96	1½ at 60 cts. per bush.
4 oz. beans	0.92	0.08	2.14	1 at 4 cts. per lb.
2 oz. lard		1.98		1¼ at 10 cts. per lb.
	4.05	2.88	24.45	12¾

No. 2.

	Proteids. Oz.	Fats. Oz.	Carbo-hydrates. Oz.	Cost. Cts.
26 oz. bread	1.82	0.13	14.35	5 at 5 cts. per loaf.
2 oz. fat cheese	0.50	0.58	0.04	1½ at 12 cts. per lb.
1 pt. milk	0.54	0.57	0.76	3 at 6 cts. per qt.
16 oz. potatoes	0.32		3.31	1 at 60 cts. per bushel.
4 oz. beans	0.92	0.08	2.14	1 at 4 cts. per lb.
1 oz. lard		0.99		⅝ at 10 cts. per lb.
1 oz. sugar			0.94	½ at 8 cts. per lb.
3 5-oz. cups tea				1 at 75 cts. per lb.
	4.10	2.35	21.54	13⅝

No. 3.

	Proteids. Oz.	Fats. Oz.	Carbo-hydrates. Oz.	Cost. Cts.
16 oz. bread	1.12	0.08	8.83	3 at 5 cts. per loaf.
4 oz. oatmeal	0.58	0.24	2.60	1 at 4 cts. per lb.
1 pt. milk	0.54	0.57	0.76	3 at 6 cts. per qt.
1 oz. sugar			0.94	½ at 8 cts. per lb.
32 oz. potatoes	0.64		6.62	2 at 60 cts. per bushel.
1 oz. lard		0.99		⅝ at 10 cts. per lb.
5 oz. fat cheese	1.25	1.45	0.11	3¾ at 12 cts. per lb.
	4.13	3.33	19.86	13⅞

No. 4.

	Proteids. Oz.	Fats. Oz.	Carbo-hydrates. Oz.	Cost. Cts.
16 oz. bread	1.12	0.08	8.83	3 at 5 cts. per loaf.
6 oz. oatmeal	0.87	0.36	3.90	1½ at 4 cts. per lb.
1 pt. milk	0.54	0.57	0.76	3 at 6 cts. per qt.
1 oz. sugar			0.94	½ at 8 cts. per lb.
4 oz. beans	0.92	0.08	2.14	1 at 4 cts. per lb.
32 oz. potatoes	0.64		6.62	2 at 60 cts. per bushel.
1 oz. lard		0.99		⅝ at 10 cts. per lb.
3 5-oz. cups tea				1 at 75 cts. per lb.
	4.09	2.08	23.19	12⅝

No. 5.

	Proteids. Oz.	Fats. Oz.	Carbo-hydrates. Oz.	Cost. Cts.
26 oz. bread	1.82	0.13	14.35	5 at 5 cts. per loaf.
2 oz. rice	0.16	0.02	1.53	1 at 8 cts. per lb.
1 egg	0.12	0.12		1¼ at 16 cts. per doz.
1 oz. lard		0.99		⅝ at 10 cts. per lb.
4 oz. beans	0.92	0.08	2.14	1 at 4 cts. per lb.
4 oz. fat cheese	1.00	1.16	0.08	3 at 12 cts. per lb.
	4.02	2.50	18.10	11⅞

No. 6.

	Proteids. Oz.	Fats. Oz.	Carbo-hydrates. Oz.	Cost. Cts.
26 oz. bread	1.82	0.13	14.35	5 at 5 cts. per loaf.
1 oz. macaroni	0.09		0.76	1¼ at 20 cts. per lb.
4 oz. beans	0.92	0.08	2.14	1 at 4 cts. per lb.
32 oz. potatoes	0.64		6.62	2 at 60 cts. per bushel.
1 oz. lard		0.99		⅝ at 10 cts. per lb.
4 oz. fat cheese	1.00	1.16	0.08	3 at 12 cts. per lb.
1 oz. sugar			0.94	½ at 8 cts. per lb.
3 5-oz. cups of tea				1 at 75 cts. per lb.
	4.47	2.36	24.89	14⅜

Although the rations suggested in the preceding tables do not contain meat, they do contain more or less animal food, and are healthy. However, the writer would not recommend one to adhere constantly to them. as some meat, while not necessary to health, does undoubtedly increase bodily vigor.

The small amount of really nutritive matter in tea is not considered. and the reader is referred to the articles "Tea" and "Coffee" for a true explanation of the food values of these drinks.

It will be seen that among vegetable foods in common use, oatmeal, beans, and potatoes are the cheapest. Since the prices vary so greatly. not only at different times, but in different parts of the country at the same time, the price at which the computation is made is given in each instance; and if the prevailing price differs from that given, any one can ascertain the change that would be produced in the total cost of the daily rations.

CLASS II.—*Very cheap daily rations with meat.*

No. 1.

	Proteids. Oz.	Fats. Oz.	Carbo-hydrates. Oz.	Cost. Cts.
26 oz. bread	1.82	0.13	14.35	5 at 5 cts. per loaf.
2 oz. codfish	1.60	0.02		1¼ at 10 cts. per lb.
2 oz. lard		1.98		1¼ at 10 cts. per lb.
16 oz. potatoes	0.32		3.31	1 at 60 cts. per bushel.
1 pt. milk	0.54	0.57	0.76	3 at 6 cts. per qt.
1 oz. sugar			0.94	½ at 8 cts. per lb.
3 5-oz. cups tea				1 at 75 cts. per lb.
	4.28	2.70	19.36	13 cts.

No. 2.

	Proteids. Oz.	Fats. Oz.	Carbo-hydrates. Oz.	Cost. Cts.
16 oz. bread	1.12	0.08	8.83	3 at 5 cts. per loaf.
1 oz. codfish	0.80	0.01		⅝ at 10 cts. per lb.
1 oz. lard		0.99		⅝ at 10 cts. per lb.
32 oz. potatoes	0.64		6.62	2 at 60 cts. per bushel.
2 oz. bacon	0.29	0.75		1½ at 10 cts. per lb.
4 oz. beans	0.92	0.08	2.14	1 at 4 cents per lb.
1 pt. milk	0.54	0.57	0.76	3 at 6 cts. per qt.
1 oz. sugar			0.94	½ at 8 cts. per lb.
3 5-ounce cups tea				1 at 75 cts. per lb.
	4.31	2.48	19.29	13¼

No. 3.

26 oz. bread	1.82	0.13	14.35	5 at 5 cts. per loaf.
2 oz. oatmeal	0.29	0.12	1.30	½ at 4 cts. per lb.
1 pt. milk	0.54	0.57	0.76	3 at 6 cts. per qt.
1 oz. sugar			0.94	½ at 8 cts. per lb.
2 oz. codfish	1.60	0.02		1¼ at 10 cts. per lb.
8 oz. potatoes	0.16		1.65	½ at 60 cts. per bushel.
2 oz. lard		1.98		1¼ at 10 cts. per lb.
3 5-oz. cups tea				1 at 75 cts. per lb.
	4.41	2.82	19.00	13

No. 4.

26 oz. bread	1.82	0.13	14.35	5 at 5 cts. per loaf.
1 oz. codfish	0.80	0.01		⅝ at 10 cts. per lb.
2 oz. lard		1.98		1¼ at 10 cts. per lb.
6 oz. beans	1.38	0.12	3.21	1½ at 4 cts. per lb.
2 oz. fat cheese	0.50	0.58	0.04	½ at 12 cts. per lb.
1 pt. milk	0.54	0.57	0.76	3 at 6 cts. per qt.
1 oz. sugar			0.94	½ at 8 cts. per lb.
3 5-oz. cups tea				1 at 75 cts. per lb.
	5.04	3.39	19.30	13⅜

No. 5.

26 oz. bread	1.82	0.13	14.35	5 at 5 cts. per loaf.
2 oz. fat cheese	0.50	0.58	0.04	1½ at 12 cts. per lb.
2 oz. bacon	0.29	0.75		1½ at 12 cts. per lb.
4 oz. beans	0.92	0.08	2.14	1 at 4 cts. per lb.
1 pt. milk	0.54	0.57	0.76	3 at 6 cts. per qt.
1 oz. sugar			0.94	½ at 8 cts. per lb.
3 8-oz. cups coffee				2 at 27 cts. per lb.
	4.07	2.11	18.23	14½

No. 6.

	Proteids. Oz.	Fats. Oz.	Carbo-hydrates. Oz.	Cost. Cts.
26 oz. bread	1.82	0.13	14.35	5 at 5 cts. per loaf.
2 oz. codfish	1.60	0.02		1¼ at 10 cts. per lb.
1 oz. bacon	0.14	0.37		¾ at 12 cts. per lb.
2 oz. lard		1.98		1¼ at 10 cts. per lb.
16 oz. potatoes	0.32		3.31	1 at 60 cts. per bushel.
½ pt. milk	0.27	0.28	0.38	1½ at 6 cts. per qt.
1 oz. sugar			0.94	½ at 8 cts. per lb.
3 8-oz. cups coffee				2 at 27 cts. per lb.
	4.15	2.78	18 98	13¼

Class III.—*Moderately cheap daily rations.*

No. 1.

	Proteids. Oz.	Fats. Oz.	Carbo-hydrates. Oz.	Cost. Cts.
16 oz. bread	1.12	0.08	8.83	3 at 5 cts. per loaf.
8 oz. beef (very fat)	1.36	2.12		8 at 16 cts. per lb.
32 oz. potatoes	0.64		6 62	2 at 60 cts. per bushel.
2 oz. oatmeal	0.29	0.12	1.01	½ at 4 cts. per lb.
1½ pt. milk	0.81	0.85	1.14	4½ at 6 cts. per qt.
1 oz. sugar			0.94	½ at 8 cts. per lb.
	4.22	3.17	18.54	18½

No. 2.

	Proteids. Oz.	Fats. Oz.	Carbo-hydrates. Oz.	Cost. Cts.
26 oz. bread	1.82	0.13	14.35	5 at 5 cts. per loaf.
8 oz. beef (moderately fat) . .	1.68	0.45		9 at 18 cts. per lb.
16 oz. potatoes	0.32		3.31	1 at 60 cts. per bushel.
1½ pt. milk	0.81	0.85	1.14	4½ at 6 cts. per qt.
1 oz. butter		0.83		1½ at 24 cts. per lb.
	4.63	2.26	18.80	21

No. 3.

	Proteids. Oz.	Fats. Oz.	Carbo-hydrates. Oz.	Cost. Cts.
26 oz. bread	1.82	0.13	14.35	5 at 5 cts. per loaf.
4 oz. mutton (very fat) . . .	0.60	1.44		4 at 16 cts. per lb.
4 oz. beans	0.92	0.08	2.14	1 at 4 cts. per lb.
1 qt. milk	1.08	1.14	1.52	6 at 6 cts. per qt.
	4.42	2.79	18.01	16

No. 4.

	Proteids. Oz.	Fats. Oz.	Carbo-hydrates. Oz.	Cost. Cts.
26 oz. bread	1.82	0.13	14.35	5 at 5 cts. per lb.
8 oz. mutton (moderately fat) .	1.36	0.48		9 at 18 cts. per lb.
32 oz. potatoes	0.64		6.62	2 at 60 cts. per bushel.
½ pt. milk	0.27	0.28	0.38	1½ at 6 cts. per qt.
1 oz. sugar			0.94	½ at 8 cts. per lb.

	Proteids. Oz.	Fats. Oz.	Carbo-hydrates. Oz.	Cost. Cts.
2 oz. butter		1.66		3 at 24 cts. per lb.
3 8-oz. cups coffee				2 at 27 cts. per lb.
	4.09	2.55	22.29	23

No. 5.

	Proteids. Oz.	Fats. Oz.	Carbo-hydrates. Oz.	Cost. Cts.
26 oz. bread	1.82	0.13	14.35	5 at 5 cts. per loaf.
4 oz. pork (lean)	0.80	0.28		3 at 12 cts. per lb.
2 oz. fat cheese	0.50	0.58		1½ at 12 cts. per lb.
32 oz. potatoes	0.64		6.62	2 at 60 cts. per bushel.
½ pt. milk	0.27	0.28	0.38	1½ at 6 cts. per qt.
1 oz. butter		0.83		1½ at 24 cts. per lb.
3 8-oz. cups coffee				2 at 27 cts. per lb.
	4.03	2.10	21.35	16½

No. 6.

	Proteids. Oz.	Fats. Oz.	Carbo-hydrates. Oz.	Cost. Cts.
26 oz. bread	1.82	0.13	14.35	5 at 5 cts. per loaf.
2 oz. sausage (best quality)	0.57	0.80		1½ at 12 cts. per lb.
2 oz. oatmeal	0.29	0.12	1.30	½ at 4 cts. per lb.
4 oz. beans	0.92	0.08	2.14	1 at 4 cts. per lb.
1 oz. bacon	0.14	0.37		¾ at 12 cts. per lb.
1 pt. milk	0.54	0.57	0.76	3 at 6 cts. per qt.
1 oz. butter		0.83		1½ at 24 cts. per lb.
1 oz. sugar			0.94	½ at 8 cts. per lb.
3 5-oz. cups tea				1 at 75 cts. per lb.
	4.28	2.90	19.49	14½

Class IV.—*More expensive daily rations.*

No. 1.

	Proteids. Oz.	Fats. Oz.	Carbo-hydrates. Oz.	Cost. Cts.
16 oz. bread	1.12	0.08	8.83	3 at 5 cts. per loaf.
2 eggs	0.24	0.24		4 at 24 cts. per doz.
2 oz. butter		1.66		4 at 32 cts. per lb.
1 qt. milk	1.08	1.14	1.52	8 at 8 cts. per qt.
1 oz. bacon	0.14	0.37		¾ at 12 cts. per lb.
1 oz. string beans	0.03		0.06	2 at 32 cts. per lb.
8 oz. mutton	1.36	0.48		9 at 18 cts. per lb.
32 oz. potatoes	0.64		6.62	2 at 60 cts. per bushel
1 oz. sugar			0.94	½ at 8 cts. per lb.
1 oz. dried fruit	0.02		0.55	1¼ at 20 cts. per lb.
	4.63	3.97	18.52	34½

No. 2.

	Proteids. Oz.	Fats. Oz.	Carbo-hydrates. Oz.	Cost. Cts.
16 oz. bread	1.12	0.08	8.83	3 at 5 cts. per loaf.
2 oz. oatmeal	0.29	0.12	1.30	½ at 4 cts. per lb.
2 oz. sugar			1.88	1 at 8 cts. per lb.

	Proteids. Oz.	Fats. Oz.	Carbo-hydrates. Oz.	Cost. Cts.
1 pt. milk	0.54	0.57	0.76	3 at 6 cts. per qt.
1 oz. macaroni	0.09		0.76	1¼ at 20 cts. per lb.
8 oz. beef	1.68	0.44		9 at 18 cts. per lb.
32 oz. potatoes	0.64		6.62	2 at 60 cts. per bushel.
2 oz. salmon	0.32	0.11		1½ at 20 cts. per lb.
2 oz. butter		1.66		4 at 32 cts. per lb.
3 8-oz. cups coffee				2 at 27 cts. per lb.
	4.68	2.98	20.15	27¼

No. 3.

20 oz. bread	1.40	0.10	11.04	4 at 5 cts. per loaf.
4 oz. beef	0.84	0.22		4½ at 18 cts. per lb.
2 oz. butter		1.66		4 at 32 cts. per lb.
2 oz. fat pork	0.29	0.75		1½ at 12 cts. per lb.
2 oz. beans	0.46	0.04	1.07	½ at 4 cts. per lb.
2 oz. starch			1.67	2 at 16 cts. per lb.
2 oz. sugar			1.88	1 at 8 cts. per lb.
2 oz. dried fruit	0.05		1.11	2½ at 20 cts. per lb.
8 oz. potatoes	0.16		1.65	½ at 60 cts. per bushel.
8 oz. lean mutton	1.36	0.48		8 at 16 cts. per lb.
3 8-oz. cups coffee				2 at 27 cts. per lb.
½ pt. milk	0.27	0.28	0.38	1½ at 6 cts. per qt.
	4.83	3.53	18.80	32

No. 4.

20 oz. bread	1.40	0.10	11.04	4 at 5 cts. per loaf.
2 oz. oatmeal	0.29	0.12	1.30	½ at 4 cts. per lb.
1 qt. milk	1.08	1.14	1.52	6 at 6 cts. per qt.
2 oz. sugar			1.88	1 at 8 cts. per lb.
2 oz. butter		1.66		4 at 32 cts. per lb.
2 oz. mackerel	0.46	0.13		1½ at 12 cts. per lb.
8 oz. chicken	1.86	0.19		12½ at 25 cts. per lb.
16 oz. potatoes	0.32		3.30	1 at 60 cts. per bushel.
8 oz. fruit (as apple sauce)			0.80	1 at $1 per bushel.
	5.41	3.34	19.84	31½

No. 5.

26 oz. bread	1.82	0.13	14.35	5 at 5 cts. per loaf.
2 oz. sausage	0.57	0.80		2 at 16 cts. per lb.
2 oz. butter		1.66		4 at 32 cts. per lb.
8 oz. lean beef	1.68	0.08		9 at 18 cts. per lb.
16 oz. potatoes	0.32		3.30	1 at 60 cts. per bushel.
2 oz. macaroni	0.18		1.53	2½ at 20 cts. per lb.
1 qt. milk	1.08	1.14	1.52	6 at 6 cts. per qt.
2 oz. sugar			1.88	1 at 8 cts. per lb.
3 8-oz. cups coffee				2 at 27 cts. per lb.
	5.65	3.81	22.58	32½

No. 6.

	Proteids. Oz.	Fats. Oz.	Carbo-hydrates Oz.	Cost. Cts.
26 oz. bread	1.82	0.13	14.35	5 at 5 cts. per loaf.
2 eggs	0.24	0.24		4 at 24 cts. per doz.
2 oz. butter		1.66		4 at 32 cts. per lb.
8 oz. lean beef	1.68	0.08		9 at 18 cts. per lb.
2 oz. beans	0.46	0.04	1.07	½ at 4 cts. per lb.
1 oz. bacon	0.14	0.37		¾ at 12 cts. per lb.
16 oz. potatoes	0.32		3.30	1 at 60 cts. per bushel.
1 oz. sugar			0.94	½ at 8 cts. per lb.
1 pt. milk	0.54	0.57	0.76	3 at 6 cts. per qt.
3 8-oz. cups coffee				2 at 27 cts. per lb.
	5.20	3.09	20.42	29¾

To the cost of the raw food, as given in the preceding tables, is to be added the cost of cooking, fuel, keeping the table, and of furnishing seasoning, such as salt, pepper, and mustard. Where six or more persons eat together, the cost of the above items, including enough to pay the wages of the cook and waiters, is from 35 to 50 cents per week for each boarder. This increases the daily cost of board by from 5 to 7 cents above the figures given in the tables.

ANIMAL FOODS.

MEATS—GENERAL PROPERTIES.

A large proportion of our daily food consists of material derived from the animal world. Other animals take vegetable food and build it up, so that it approximates in physical and chemical properties the flesh of man. Of the foods thus derived from the animal kingdom, meat is one of the most important. Meat consists of different food-stuffs, as water, mineral salts, albumen, and fat. On an average, 100 parts of beef consist of 72 parts of muscle, 8 parts of fat, and 20 parts of bone (including cartilage and tendon). The age of the animal, and the manner in which it has been fitted for market, have a marked effect upon the composition of the flesh. Veal contains 3 per cent. more of water, and a corresponding amount of solid substance, than lean beef. Fat beef may contain as much as 10 per cent. less of water than lean beef. The same is true of the difference between mutton and lamb. Of all the kinds of flesh eaten, fat bacon contains the least amount of water. The average per cent. of water in bacon is 60, while that in lean beef is 75. The flesh of wild fowl, chickens, and pigeons furnishes on an average 77 per cent. of water. Fish is especially rich in water, the carp yielding 80 per cent. The fat in lean beef, veal, and mutton may be as low as from 1 to 1½ per cent., while that of fat beef is 14, of fat mutton 9, veal 6, and bacon 24. Along with these variations in the amounts of water and fat there are corresponding changes in the quantity of nitrogenous material. As a rule,

fish is poorest in nitrogenous substance, the per cent. in carp and salmon being 13, in pickerel 15; fat veal, mutton, and bacon, 15; fat beef, 16; lean beef, 22.

The following rules may govern us in the selection of meats:

Good beef has a reddish-brown color, and contains no clots of blood. Well nourished beeves furnish a flesh which while raw is marbled with spots of white fat; it is firm and compact. Old, lean animals furnish a flesh which is tough, dry, and dark; the fat is yellow. Veal is slightly reddish, and has tender, white fibres. The fat is not distributed through the lean, as in beef. The same is true of mutton. In well nourished animals, white fat accumulates along the borders of the muscles.

Pork is rose-red, and has fat distributed through the muscle. The lard is white, and lies in heavy deposit under the skin. The flesh of an old boar is dark, and often has an unpleasant odor and taste.

Good beef is not of a pale pink color, and such a color indicates that the animal was diseased. Good beef does not have a dark purple hue, for this color is evidence that the animal has not been slaughtered, but has died with the blood in its body, or has suffered from some acute febrile affection.

Good beef has no, or but little, odor; or if any odor is perceptible it is not disagreeable. In judging as to the odor of meat, pass a clean knife, which has been dipped in hot water, through it, and examine subsequently as to the odor of the knife. Tainted meat often gives off a plainly perceptible and disagreeable odor while being cooked.

Good meat is elastic to the touch. Meat that is wet and flabby should be discarded. It should not become gelatinous after being kept in a cool place for two days, but should remain dry on the surface and firm to the touch.

The flesh of young animals is more tender than that of the adult, but experiment, as well as experience, has shown that the former is less easily digested. For instance, veal and lamb are less easily digested, and tax the stomach of the dyspeptic more than beef and mutton. Dr. Smith has shown that this is largely due to the fact that the flesh of young animals cannot be perfectly masticated. The tissues of the young animal are less stimulating, less nutritious, and more gelatinous than the tissues of the adult animal. On the other hand, it is well known that an animal may be so old and poorly nourished that its flesh well-nigh defies both mastication and digestion. The common breeds of cattle are best fitted for the market at the age of 7 years; the better breeds earlier.

It makes a difference whether the special meat be served in or out of season. Beef is in highest season in the early months of winter, after the animal has been furnished abundant pasturage, though not absolutely out of season at any time of the year. Fresh pork is wholly out of season during the hot months of summer. Christison found in salmon, before the spawning season, 18.5 per cent. of fat and 39 per cent. of solids; after the spawning season, 1 per cent. of fat and 20 per cent. of solids.

In most cases, animals are fattened for the table. Some fat is desira-

ble, as it renders the meat more juicy, and develops an agreeable flavor. But the process of fattening is often carried too far. Fat should be taken in a finely divided state, for when swallowed in lumps it is well-nigh indigestible. Many a child, which has been reproved for refusing to eat fat meat, will readily take the same amount of fat, as butter, spread upon bread. The manner in which the animal has been killed affects the meat. Slaughtering is usually so conducted as to remove as much as possible of the blood. Either death is produced by the withdrawal of blood, or the blood is withdrawn as soon as possible after death. The removal of the blood enables the meat to be kept with more ease; it also improves the flavor.

In warm countries meat is often cut from the animal and cooked as soon as death is produced, and before *rigor mortis* (the stiffness of death) sets in. While the rigor is on, the meat is more difficult of mastication and digestion. In temperate latitudes the flesh is usually kept until this rigidity naturally passes off. This may be aided by pounding the meat after it has been cut into thin pieces. With us, the only animals which are cooked before rigor sets in are fish, frogs, some mollusks, frequently domestic fowls, and sometimes wild game.

The flesh of wild animals is richer in nitrogen and flavor, and contains less fat, than that of the same species kept in domestication.

Meat which has been frozen decomposes easily after being thawed out, and when cooked it is dry and insipid.

The ancient Egyptians and Chaldeans were acquainted with the fact that the flesh of diseased animals might harmfully affect those eating of it, and among them the use of such flesh as food was prohibited. The strictest measures were taken to see that the meat furnished their kings and priests was obtained from healthy animals. Even during the dark ages this prohibition of the use of flesh from diseased animals continued. During the eighteenth century, however, it was found that the inhabitants of besieged towns ate of such food when starvation threatened them, and without any marked detriment to health. The flesh of a diseased animal does not necessarily convey the malady to the consumer; but in order to prevent such transmission the cooking must be thorough. That phthisis (consumption) may be imparted to dogs by feeding them upon tubercular flesh has been proven experimentally. Dr. Livingston states that the use of the flesh of animals afflicted with pleuro-pneumonia produces carbuncle. In Germany and France many cases of anthrax or malignant pustule in man have arisen from partaking of the flesh of animals with this disease. The flesh of sheep with the small-pox, and of oxen with the cattle plague, has affected those partaking of it. Then there are the parasites, trichinæ, cysticerci (in "measly" meat), and echino-cocci (flukes), which may be transmitted to man. If every part of the meat be raised to a temperature of 160° Fahr. during cooking, these parasites are destroyed; but if the blood-red juices exude from the interior of the piece of meat on being cut, the parasites, if present, may still retain their vitality.

The eating of the flesh of diseased animals is admissible only when no better food can be secured, and when starvation threatens. The sale of such meat is prohibited by law, and any one guilty of such an outrage should be punished to the fullest extent.

The flesh of a healthy animal may become poisonous from partial decomposition. By the putrefaction of albuminous substances, certain organic poisons are generated. The symptoms produced resemble those of severe cholera morbus, and a fatal termination is not infrequent. These cases most frequently arise from eating sausage and canned meats, though they may be due to any meat which is partly putrid.

Gerlach, director of the Royal Veterinary School at Berlin, gives the following list of meats which should not be eaten:

(1) The flesh of all animals which have died of internal diseases, or which have been killed while suffering from such diseases, and of healthy animals which have been killed by over-driving;

(2) The flesh of animals with contagious diseases which may be transmitted to man;

(3) The flesh of animals which have been poisoned;

(4) The flesh of animals with severe infectious diseases, such as blood poisoning;

(5) Flesh which contains parasites that may be transmitted to man;

(6) All putrid flesh.

METHODS OF COOKING MEAT.

In boiling meat, if it is desired to retain the juices, the piece should be large, and should be placed at once in boiling water, and the boiling continued for five minutes. Then the temperature of the water should be allowed to fall to 160° Fahr., at which point it should be maintained until the meat is done. The boiling water coagulates the outside of the meat, and thus prevents the escape of the juices. If the temperature be kept at or near the boiling point throughout the process, the flesh shrinks, becomes tough, loses in flavor, and is finally digested with much difficulty.

On the other hand, if the object of the boiling is to make a good soup, the meat should be cut into small pieces, placed in cold water, and the temperature gradually raised to from 150° to 160° Fahr. Chicken broth is the most nutritious; mutton next; while beef makes a very weak broth. By boiling, meat loses, as a rule, from 25 to 30 per cent. of its weight.

In roasting, the oven should at first be very hot; then it should be cooled down, and the process continued at a low temperature. Since the heat applied to every portion of the outside of the meat cannot be so uniform in roasting as in boiling, the loss is usually greater in the former than in the latter.

Stewed meat is that roasted in its own juices. The meat is cut into small pieces, and the cooking should be carried on at as low a temperature as possible. The extracted matter should be served with the meat.

Often vegetables are stewed with the meat, thus improving the flavor of the former.

Proper cooking renders the meat more agreeable to the senses of sight, smell, and taste, and thus through the nervous system it stimulates the flow of the digestive fluids. One of the most fruitful sources of error in the cooking lies in using too high a temperature.

BRIEF CONSIDERATION OF THE MEATS IN COMMON USE.

Beef. Among all civilized people beef is regarded as the principal animal food. By common consent we admit that beef is more nutritious than any other kind of flesh. This universal opinion is supported by the investigations of science. There is a larger proportion of nutritious material in beef than in the flesh of the sheep or hog. Beef is of closer texture, and is fuller of red-blood juices. It is richer in flavor than the flesh of any other domestic animal, and a smaller amount of it will satisfy hunger. Siegert gives the following figures, showing the average per cent. composition of the flesh taken from different parts of a lean and a fat ox:

	Lean Ox.			Fat Ox.		
	Neck.	Sirloin.	Shoulder.	Neck.	Sirloin.	Shoulder.
Water,	77.5	77.4	76.5	73 5	63.4	50.5
Fat,	0.9	1.1	1.3	5.8	16.7	34.0
Muscle,	20.4	20.3	21.0	19.5	18.8	14.5

On an average, 65 per cent. of the live weight of an ox may be converted into salable meat, the exact proportion varying with the degree to which the animal has been fattened. The greater the amount of fat, the less the proportion of bone and other waste.

Not only does beef from different animals differ in composition, flavor, and digestibility, but that from various parts of the same animal varies. The flesh from the different parts of the carcass is divided into the following four classes, according to quality:

Class I. Porterhouse, sirloin, and best cuts from the rump: Price per pound, 15 cents.

Class II. Round, shoulder, ribs, top ribs, flank steak, plate, and skirt, 12½ cents.

Class III. Best parts of neck, brisket, and flank, 8 cents.

Class IV. Poorer parts of neck, flank, and brisket, 7 cents.

Pieces of shank and bone are usually sold by the piece, and not by the pound. The prices vary in different sections of the country and at different times, but the writer gives the above figures for the purpose of showing the difference in value of different parts from the same animal.

Veal. In many sections of the country calves of all ages are slaughtered. In some cities, as in Boston, the killing of a calf under one month of age for food is prohibited. It would be well if this law, or a more extensive one, should be enforced all over the country. Veal is too often used simply as a dish to please the taste. As has been remarked,

it is not nearly so nutritious as beef, and is much more difficult of digestion. Some persons are wholly unable to digest veal, and when they eat of it, it acts as a foreign body in the intestines, and causes griping and diarrhœa. Dr. Smith states that it is more easy of digestion when well roasted or broiled than when boiled. The time required for the digestion of veal is five hours or more, while beef is digested in from two and a half to three hours.

The mode of killing often practised in this case has a special influence on the nutritive value of the food. Veal is bleached by repeatedly bleeding the animal for some days, and at last allowing it to bleed to death. The bones of calves contain much animal matter, and for this reason they are used for the production of gelatine ; and calves' feet are selected for the preparation of jellies, which are often very acceptable to the sick.

Mutton. This is more easily digested than beef, though in a healthy man no marked difference would be observed, since in the stomach of such a man there arises no inconvenience from the digestion of beef. However, mutton will be found to tax the stomach of the dyspeptic less than beef does, and mutton broth is both acceptable and valuable to a person suffering from dysentery or kindred affections of the bowels. But mutton is not so nutritious as beef.

In dressing a mutton, the woolly coat should not be allowed to touch the flesh. There is quite a perceptible difference in the flavor of mutton taken from a fattened wether, which has been for some time deprived of all excess in his woolly coat, and of that taken from a sheep which has a heavy fleece. The smallest proportion of both fat and bone to muscle is found in the leg ; consequently this is the most valuable part of the animal.

Lamb. This is not nearly so nutritious as mutton. The tissue is soft, gelatinous, and rich in water. It is used principally on account of its delicacy of flavor, which, however, is very variable, depending upon the breed and nourishment. Lamb should not be selected for those whose digestive organs are weak.

Pork, Bacon, and Ham. As a rule, dried meats are more difficult of digestion than the same meats in the fresh state. Bacon and ham are, however, exceptions to this rule, for when well cured they are digested with more ease than fresh pork. In cold weather, nice bacon is especially suited for furnishing a large amount of heat by its oxidation in the body. The inhabitants of cold countries find fatty food necessary to their existence.

For several reasons, the flesh of the hog must continue to form one of the most important sources of our food. This animal can be fattened more readily and at less cost than either the ox or sheep. The best breeds of pigs store up in their bodies three times as much of the food which they eat as the ox does. Then the flesh can be cured easily and preserved indefinitely. Again, the animal multiplies rapidly and reaches maturity speedily.

On the other hand, of all the meats ordinarily eaten, this is most likely

to be diseased. "Measly" pork can, as a rule, be recognized by the unaided eye on close inspection. The meat is dotted with grayish-white specks, about the size of a pea; but "measly" pork is often cut up into sausage, in which the diseased condition escapes recognition. The "measles" (cysticerci), taken into the stomach of man, develop into tape worms. Then there are the trichinæ, which can be recognized only by the aid of the microscope. These little parasites penetrate the muscles of man, causing great suffering, which often terminates in death. These parasites occur so frequently in pork and its cured products, that every one should always remember that the flesh of the hog should not be eaten unless it has been thoroughly cooked. As we have stated, these parasites are destroyed if the temperature of every part of the meat be raised to 160° Fahr. during cooking.

Fowl. There is no bird that may not be eaten in case of necessity. In other words, the flesh of no bird is in itself poisonous. The same is true of the eggs of all birds. It is true that cases of poisoning from eating quails, during spring, have occurred; but the poisoning was due to the buds of the mountain laurel, upon which the birds fed. The flesh of carnivorous birds is strong in odor and in taste, and would not form a tempting dish, save to one threatened with starvation. The light meats of birds are more easily digested, less rich in nitrogen and in flavor, than the dark meats. Chicken broth is more nutritious than that made from either mutton or beef, and is often of great value to the sick.

Fish. Undoubtedly the flesh of some fish is poisonous. A fish is said to justify suspicion when it has attained a size unusual for one of its species This popular idea may have a grain of truth in it. Fish should be discarded if the water in which it is being boiled blackens silver. The coloration is due to hydrogen sulphide (the gas of bad eggs), and indicates putrefactive changes. Decomposing fish has a pale look, and its belly is bluish. It is withered, sticky to the touch, and foul in odor. The seller sometimes tries to hide the evidence of decomposition by taking the eyeballs out and coloring the gills with blood. Fish caught from putrid water should not be eaten. Sometimes, near large manufacturing establishments where a great deal of refuse is thrown into the water, the fish are killed, and may be brought to market. The flesh of such fish is yellowish, soft, spongy, and of foul odor. Fish may be divided into those furnishing white and those furnishing red meats. Those of the former class, as the whitefish, are delicate and easy of digestion, while those of the second class are richer in nitrogen, and more stimulating. Fish should not be left in the water after they are dead, but should be packed in ice.

Fish should not be the chief flesh diet of a people, because it is not sufficiently stimulating. Indeed, it is doubtful if any class of people would voluntarily confine themselves to such food.

But the occasional use of fish forms a change which is both agreeable and beneficial. There is no truth in the popular idea that a fish diet is especially suited to the development of the brain and nervous system.

Along with fish are often classed certain crustaceans, as the crab and lobster, and certain mollusks, as the oyster and mussel. The oyster and mussel are gelatinous, but are easily masticated and digested. The lobster, crayfish, and crab are more muscular, and are somewhat more difficult of mastication and digestion. The nutritive value of the oyster is not very great, but its delicacy of flavor and ease of digestion make it of great value to all, and especially to the sick. The raw oyster is probably more easily digested than the cooked.

The crab and lobster are of considerable nutritive value, though, on account of price, they are used principally as delicacies.

Sausage. The food value of sausage depends upon the substances out of which it is prepared. If made from good meat it forms a very valuable preparation, as by this means all the small bits are collected and saved. But its method of preparation allows of the introduction of poor grades of flesh, and of several adulterations.

The adulterations which have been found in sausage are meal, to increase the bulk and the profit; salicylic acid and borax, to prevent decomposition; and a red coloring matter (fuchsin), to give the poorer quality of meat a better color. The liver sausage (leberwürste of the Germans) is made by grinding up liver, lungs, kidney, tendon, soft cartilage, and fat; sometimes meal is added. The so-called white sausage, which is used to some extent in this country, is made by mixing the crumbs of white bread with the meat. Blood or red sausage consists of a mixture of blood, fat, and flesh, with or without meal. Pea sausage is a well known preparation in France, where it is patented and warranted not to become rancid. It is of variable composition, but consists principally of ground pease with meat, and some preservative, as salicylic acid. The writer does not know of its introduction into this country.

Sausage poisoning, which is common and so often fatal in parts of Germany, is fortunately very rare in this country, though a similar affection from canned and dried meats is becoming too frequent. The poison is generated by partial decomposition. Sausage which has a putrid odor, or rancid taste, or has greenish or yellow spots in its interior, should not be eaten. Bad sausage, and other similar meat preparations, are usually, in the interior at least, soft and sticky, and when broken show small cavities. This is true even when the outside appears to be all right.

Meat Extracts. Liebig's meat extract, which is now so well known, is made by boiling lean meat with from eight to ten times its volume of water, removing the insoluble parts, fat and albumen, and evaporating to the consistency of a syrup. About thirty pounds of meat yield one pound of extract. Meat extracts are made on the largest scale in South America, from cattle which are wholly worthless for beef.

It will be seen that this extract consists only of those constituents of the meat which are soluble in water, and they are certain crystallizable organic bodies and the inorganic salts. All the really nutritive parts of the meat are insoluble in water, and are not, therefore, present in the extract. Liebig's extract and similar preparations are agreeable in

taste and odor, and are valuable stimulants, often improving the appetite, so that more valuable foods are demanded and digested. As stimulants, they are of great value to the sick; but some other food should also be supplied. A German deprived two dogs of all solid food, giving one only water, and the other meat extract. The one furnished with the extract lost flesh more rapidly than the other, and died first.

Beef-Tea. This should be prepared as follows: Cut the beef-steak into fine pieces. Put the chopped meat, *without any water*, into a small vessel, which is set into a kettle of warm water. Heat gradually, keeping the water in the kettle above blood-heat, but do not allow it to boil. Remove the small vessel containing the meat and the juice which has exuded from it, strain its contents, season, and serve.

As thus prepared, beef-tea is somewhat more nutritious than Liebig's extract; still, its chief value is to those who need a stimulant, and to those for whom a very small amount of food is sufficient.

Fluid Meats and Peptones. These are supposed to be formed by artificial digestion, whereby the same products are produced as in the stomach. The best of them are of value; others are worthless. They are to be regarded as medicines, and are to be used according to the directions of the physician.

Bone and Cartilage. Bone consists of a gelatine forming organic substance, and of mineral salts. Besides, the marrow contains considerable fat and a little albumen. About one third of bone is organic matter, a large part of which is soluble in boiling water. For this reason, bone is of value in making soups. The long bones are not acted upon by water readily, unless they first be cut or ground into small pieces. The bones of the spine and the ribs make a very nutritious soup, which yields as much as twenty-four per cent. of the weight of the bone in solid matter. Bones should be boiled for several hours, in order to get all the food-stuffs out of them. When we remember that these soups are also used for the purpose of serving vegetables, we may appreciate the real value of bone as a source of food.

MILK.[1]

Milk is a white, yellowish white, or bluish white fluid. It consists of a colorless fluid holding milk globules in suspension. These globules render the fluid opaque.

The reaction of fresh milk (cows') is sometimes alkaline, sometimes acid; but, as a rule, it gives both reactions, turning blue litmus paper red; and red litmus, blue.

Composition. Milk contains representatives of all the classes of food. The albuminous constituents are casein and albumen. The former is coagulated when the milk becomes sour, or on the addition of an acid, or by the action of rennet. The albumen is precipitated by heat. The

[1]As cow's milk is the only kind that is used as a commercial food in this country, all the statements made will refer to this kind unless some other kind be specified.

amount of casein is much larger than that of albumen. There is also a nitrogenous constituent which is not coagulated by either heat or acids.

The fat of milk forms butter, and the importance of this constituent is so great that we often decide as to the value of a given sample of milk from the amount of butter which it yields.

Milk sugar has the same chemical composition as cane sugar; but they differ somewhat in their physical properties.

If some milk be evaporated to dryness and the residue be burned, there remains a flaky, white ash, which contains all the inorganic salts which are absolutely necessary to the body.

The following table gives the average per cent. composition of milk:

Water.	Casein and Albumen.	Fat	Milk Sugar.	Ash
87.5	3.5	3.5	4.8	0.7

Colostrum. The fluid which the cow yields directly after calving is known as colostrum, which differs essentially in composition from milk, and is unfit for human food. It gradually, however, approximates milk, and the change may be regarded as complete by the eighth or tenth day. The fat of colostrum is in large lumps, and it contains much more albumen than milk does. Its average composition is shown by the following figures:

Water.	Albumen and Casein.	Fat.	Milk Sugar.	Ash.
73.07	19.21	3.54	3.00	1.18

The Care of Milk. Milk should not be allowed to stand in copper, brass, or zinc vessels, nor in earthen vessels which are lined with lead glazing; for if the milk should become at all sour, traces of the metal may be dissolved in it. There is no objection to wooden vessels if they are kept scrupulously clean. But when emptied they should be scalded with boiling water, and then dried before they are refilled. There are also no objections to the best glazed earthen or to well tinned vessels.

Milk should not be allowed to stand uncovered in an occupied room, especially in a sitting- or a bed-room. The fluid rapidly absorbs gases which may set up putrefactive changes in it. Besides, the dust which falls into it may contain disease germs, and these, finding a suitable place for their development, may multiply rapidly. There can be no question that milk has often served as the vehicle for distributing the germs of scarlet fever and diphtheria, which have fallen into it, or have been introduced with the water which has been used in diluting the milk, or for washing the vessels in which it is carried.

Souring of Milk. This fluid, on standing, sooner or later becomes distinctly sour, and its casein is coagulated. This is due to the action of a ferment, which is always present in the milk, on the milk-sugar, which is converted into lactic acid. The coagulated casein is known as "clabber," and the fluid portion forms whey. The best method of retarding the souring process in milk consists in keeping it in a cool place.

Boiling has a similar effect, but it alters the nature of the fluid more or less. Milkmen sometimes add bicarbonate of soda to milk to prevent its souring. The alkali simply neutralizes the acid as fast as it is formed.

Adulterations. While a great deal that is sensational has been said about the adulterations of milk, these frauds are perpetrated too frequently. A food which forms the principal, and in many instances the sole, sustenance of children, should be kept free from any adulteration which in any way lessens its nutritive value. To furnish a child with watered milk is often to slowly starve it to death, and the person guilty of such an act should be treated as a criminal.

The adulterations practised in the sale of milk are as follows:

(1) The addition of water, (2) the removal of more or less of the cream, (3) the addition of some foreign solid substance to increase the opacity or density of the fluid.

The addition of water is the fraud most commonly practised. The amount added varies from ten to fifty per cent. of the milk; though the former figure is probably the one most frequently approximated. Several states have laws defining the amount of milk solids, which must be present. Wherever these laws are enforced they form a valuable protection to the consumer, and to honest dairymen as well. Unfortunately, there is no ready test capable of being used by any one, by which the exact amount of water can be determined. The amount of cream which forms on a given volume of milk standing in a tall glass tube or other vessel is a rough but valuable method which every housewife may employ. From this she cannot say with certainty to her milkman that he has watered his milk, but she can tell him that the milk is not as rich as it should be.

However, it must be remembered that the cream rises on milk much quicker under some conditions than under others. Watery milk may be produced by feeding cows upon sloppy food, such as the refuse from breweries, as well as by the direct addition of water. Besides, watery milk often has a bluish color, and is not as opaque as healthy milk: though this appearance is sometimes hidden by the addition of a yellow coloring substance, annatto.

Skimmed milk is frequently sold for whole milk. In certain states there are very excellent laws against such a practice. The same rough test may be made as given above for watered milk. Sometimes skimmed milk is added to an unskimmed portion, and then sold as whole milk.

The addition of foreign solids is not frequently resorted to. The most common substance used is bicarbonate of soda for the purpose of preventing the souring of the milk, as has already been stated. In the amount used, it does not affect the food value of the milk. It is frequently said that chalk, gypsum, and gum arabic are added to milk. They may be used occasionally; but stupid indeed must be the consumer who would not detect these substances, which, on account of their insolubility, would be deposited in the vessel. It has also been stated that the brains of calves and other animals are pulverized or ground fine, and placed in

milk. This is an adulteration found in sensational books, but not in milk.

Diseased Milk. There can be no question about the possibility of the transmission of certain diseases from the lower animal to man through the use of milk as a food. In inflammation of the udder, the secretion of the gland is diminished, and the act of milking causes the animal much pain. The milk is of unpleasant odor, and contains lumps of coagulated casein and albumen, and sometimes blood and pus. Such milk may cause irritation and even inflammation of the stomach in children. In all acute febrile diseases of cows the amount of the secretion is diminished, and in severe fevers the flow of milk ceases altogether. In chronic diseases, as those of the digestive organs, the milk becomes thin and watery.

The cause of the disease known as milk-sickness, which has prevailed in certain parts of Illinois, Indiana, Kentucky, Tennessee, Georgia, and some other states, has never been ascertained. Some ascribe it to plants which the cows eat; others are equally certain that the drinking water is the source. As the country becomes more improved, the disease appears less frequently. This would lead us to suppose that the poison is obtained from some native plant which is destroyed by cultivation of the soil.

Unfortunately, in many diseases of cows, during the first stages at least, the changes in the character of the milk are not sufficiently marked to be observed;—however, the following kinds of milk should be avoided:

(1) Milk which becomes sour and curdles within a few hours after it has been drawn, and before any cream forms on its surface. This is known in some sections as "curdly" milk, and it comes from cows with certain inflammatory affections of the udder, or with digestive diseases, or from those which have been over-driven or worried.

(2) "Bitter-sweet milk" is that whose cream has a bitter taste, is covered with "blisters," and frequently with a fine mold. Butter and cheese made from such milk cannot be eaten on account of the disagreeable taste.

(3) "Slimy milk" can be drawn out into fine ropy fibres. It has an unpleasant taste, which is most marked in the cream. The causes which lead to the secretion of this milk are not known.

(4) "Blue milk" is characterized by the appearance on its surface, eighteen or twenty hours after it is drawn, of small indigo-blue spots, which rapidly enlarge until the whole surface is covered with a blue film. If the milk be allowed to stand for a few days, the blue is converted into a greenish or reddish color. This coloration of the milk is due to the growth of a microscopic organism. The butter made from "blue milk" is dirty-white in color, gelatinous in consistency, and bitter in taste.

(5) "Barn-yard milk" is a term used to designate milk taken from unclean animals, or those which have been kept in filthy, unventilated stables. The milk absorbs and carries the odors, which are often plainly perceptible. Such milk may not be poisonous, but it is repulsive.

The Value of Milk as a Food. The importance of this article of diet can hardly be be over-estimated. For children, it is the mainstay. For adults, it is a substance palatable and easily digested. About two quarts of good rich milk per day will support life, even if no other food be taken. One sick with a wasting disease, such as typhoid fever, has his chances of recovery greatly increased if he takes milk with comfort and digests it with ease. For the infant, there is no other food which can fully supplant the milk of the mother. Physicians of large experience say that the chances of rearing a babe are 50 per cent. better when it is well supplied with healthy milk by its mother than when nourished by artificial preparations. Woman's milk contains less fat and casein, and more sugar, than the cow's milk. When it becomes absolutely necessary to substitute the latter for the former, the cow's milk should be diluted with one third its volume of warm water, and one half ounce of milk-sugar should be added to each pint. As the child grows older, the amount of water added should be diminished, until, at the age of six months, undiluted cows' milk may be used.

Condensed Milk. This is prepared by evaporating milk in a vacuum to one fifth its volume, or to the consistency of honey, placing it in cans, which are set in water, the temperature of which is raised to the boiling point, when the cans are sealed. Sometimes cane sugar is added after evaporation. When used, condensed milk is diluted with five times its volume of warm water. It forms a valuable substitute for fresh milk when the latter cannot be obtained. Its exact value will depend upon the quality of the milk used in its preparation. The three most prominent brands of this preparation used in this country are the Anchor, the Swiss, and the Anglo-Swiss. The writer has examined these, and found them all of good quality.

BUTTER.

Of all the fats, butter is the most palatable and most easily digested. Only when it is rancid does it lead to dyspepsia. It, like all other fats, should be taken in a finely divided state. Its food value is great, and the amount consumed per head daily is about one ounce.

Physical Properties. Good butter is of a pale yellow color, which is uniformly diffused through it. The exact color of butter varies with the food of the cow: but as a yellow butter is universally demanded in market, makers almost invariably use a preparation of annatto. This artificial coloration has been so long practised, and as the use of the coloring material is not detrimental to health, it may be regarded as a legitimate use. Good butter is free from rancid taste and odor. White lumps in butter are due to the coagulation of casein, from the milk becoming too acid, and its incorporation with the cream. When a watery fluid exudes from the freshly cut surface of butter, it is evidence that the buttermilk was not expressed as thoroughly as it should have been, or that water has been added for the purpose of increasing the weight.

Composition. The amount of water in butter will depend upon the

manner of preparation and the quantity of salt added. In some families an unsalted butter is used. This does not contain more than from 3 to 6 per cent. of water. But as a rule more or less salt is added in making the butter. This is done to insure the preservation of the fat, and most people consider such an addition an improvement to the taste. Good salted butter will not contain more than from 10 to 15 per cent. of water, while the poorer grades may contain as much as 28 per cent. This large amount is taken up only when boiling water is mixed with the fat, and then the whole allowed to cool.

The salt used in butter should be finely pulverized and thoroughly mixed with the fat. From 3 to 5 per cent. of salt is all that is needed for preservation, but in order to increase the weight, from 10 to 15 per cent. is sometimes added. Good butter contains from 85 to 90 per cent. of fat, and any which contains less than 82 per cent. may be considered as adulterated. The most common fraud in regard to the fat consists in the use of tallow and lard, which will be discussed under the heads of oleomargarine and butterine.

The greatest amount of casein permissible in butter is 2 per cent. If there be much more present, the butter is lumpy. There is now being sold to dairymen a recipe by which it is guaranteed that a given volume of milk will be made to yield 25 per cent. more of butter. The process consists in the coagulation of all the casein in the milk, and its incorporation with the fat. The product is really not butter at all, but an inferior soft cheese. An excess of casein in butter increases its liability to become rancid.

How to Take Care of Butter. Butter, like milk, takes up unpleasant odors: for this reason it should not be allowed to stand exposed to the air of occupied rooms, nor in other places that may become foul. When freely exposed to air butter becomes rancid: it should be tightly packed and covered. Warmth hastens rancidity: it should be kept in a cool place.

OLEOMARGARINE AND BUTTERINE.

Oleomargarine. This substance is now largely manufactured and sold in this country, generally under the name of butter, but sometimes under its proper name. It is made as follows: The best beef fat is cut from the carcass while it is still warm. All bloody portions, and those tainted in any other way, are rejected. The selected fat is placed in fresh cold water, in which it is both cooled and washed. It is then ground like sausage. Then it is heated from 160° to 180° Fahr., by which the oil is separated from the membranes. The oil, after being salted, is cooled, and then pressed. Then it is placed in milk, a preparation of annatto added, and the whole churned, when it is worked as butter. The temperature at which the oil is separated from the membrane should be as low as possible; but in practice it varies within large limits. Some manufacturers use a heat of only 120°, while others allow the temperature to run up to 200° F. The oil thus prepared is known to the trade as "butter oil."

Butterine. This is prepared by the mixture of "butter oil" obtained from beef fat, as in making oleomargarine, and a similar oil obtained from hog fat, and churning with milk. The oil from the lard is separated at a temperature not exceeding 120° F.

A great deal has been said against the use of these preparations as foods. Several states have laws which require that when such articles are sold, the buyer shall receive them from a vessel which is labelled with the word Oleomargarine, or Butterine, as the case may be, in letters one inch high, and the portion taken by the buyer shall be covered with a paper which also bears the true name of the fat. This law is certainly a just one, as every article of food should be sold under its proper name; and the price of good butter should not be demanded for these imitations. At least two states,—New York and Michigan,—have enactments which wholly forbid the manufacture and sale of these preparations. These laws are both unwise and unjust. Oleomargarine and butterine are valuable food-stuffs. They are not equal to the best grades of butter, but are far superior to the poor, partly rancid butter which is so generally sold in the large cities. As has been seen from the methods of preparation given above, only the very best pieces of fat can be used. Any fat which has an unpleasant odor, or is in the least degree foul, must be rejected, for there is no method known for removing the odor.

One of the greatest dietary needs of the working-man is a sufficient supply of an inexpensive, wholesome fat. This will be largely met by these artificial butters.

CHEESE.

Cheese is of considerable nutritive value, one pound containing as much nitrogen as two pounds of meat, and as much fat as three pounds of meat; but, as a rule, cheese is difficult of digestion, and can be taken only in small amount at a time. Moreover, the exact composition of cheese is quite variable. It is made both from whole and skimmed milk, and at present some is made from skimmed milk to which oleomargarine or butterine has been added. The dairyman skims his milk, making butter from the cream; then to the skimmed milk he adds the fatty preparation, and makes cheese. In this way the same milk is made to produce both butter and cheese. It is a popular idea, that while cheese itself is digested with difficulty, a small amount of it in the stomach aids the digestion of other substances. The experiments of Dr. Edward Smith have confirmed this belief. As digestion is partly due to fermentation, and since cheese contains certain ferments, the belief is not irrational; but when taken as an aid to digestion, the amount should be very small, not more than from one half to one ounce.

True cream cheese is made from whole milk, to which cream has been added; but what is ordinarily known as "cream cheese" is that made from unskimmed milk. In such a cheese, the proportional amounts of casein and fat are substantially the same as in good milk. Skimmed

milk cheese is not so nutritious and not so easy of digestion as that made from whole milk.

Cheese is almost universally colored with annatto, which, as it has been so long used and is not detrimental to health, may be regarded as a justifiable adulteration. Without it, cheese would be of a dingy-white color.

EGGS.

There is no bird whose eggs may not be eaten in case of necessity. However, the eggs of flesh-eating birds are of strong, unpleasant odor. Practically, our use of eggs as food is confined to those of the chicken, duck, Guinea hen, and goose. The exact taste of eggs is influenced largely by the food of the bird. The nutritive value of eggs is great, both on account of their chemical composition and their flavor. The average weight of hens' eggs is from 1½ to 2 ounces, the parts existing in the following proportions:

Shell,	11.5 per cent.
Albumen (white),	58.5 "
Yolk,	30.0 "

The white of the egg consists of water and albumen, with traces of inorganic salts and fat. The yolk contains from 30 to 32 per cent. of fat; so that, practically speaking, the fat is confined to the yolk. There is not much difference in the time required for the digestion of a raw egg and one which has its albumen coagulated by heat, but the latter is the more agreeable in flavor. A hard-boiled egg is digested with more difficulty than one rarely done.

Since eggs are most abundant and consequently cheapest during spring and summer, their preservation is of considerable importance. When left exposed to the air, germs pass through the shell and cause decomposition. Consequently, the object to be held in view in endeavoring to preserve them is to exclude the air. This may be done by placing them in lime-water; but in this way the shells are made very brittle, and many are broken in removing them. They may be dipped in mucilage, and then packed in salt. However, the most common method consists simply in packing them in salt alone, or in salt and lime. Some dip the eggs for a moment in boiling water, whereby the part of the white immediately in contact with the shell is coagulated.

Decomposed eggs will float in brine (made by dissolving one part salt in ten parts of water), while fresh eggs placed in the same solution will sink.

VEGETABLE FOODS.

CEREALS AND GRAINS.

The cereals used as food in this country are wheat, rye, oats, corn, and rice. The most important food constituents of the grains are starch,

proteids or nitrogenous substances, and the phosphates of the ash. They also contain small amounts of fat, sugar, gum, and mineral substances other than the phosphates.

Of all the grains, wheat is considered the most nutritious. Its exact composition varies slightly, according to climate, nature of the soil, and the fertilization employed. Its average per cent. composition is given in the following figures:

Water.	Proteids.	Fat.	Sugar.	Starch.	Cellulose.	Ash.
13.56	12.42	1.70	1.44	64.07	2.66	1.79

The nitrogenous substances consist of vegetable albumen, casein, and gluten. The last mentioned forms by far the greater part of the nitrogenous material. The ash may contain as much as 45 per cent. of phosphoric acid, which is combined with lime, magnesia, and potash. As a rule, the greater the amount of phosphoric acid in the ash of the wheat, the greater the amount of nitrogenous matter in the grain.

Rye does not differ greatly in its composition from wheat, as is shown by the following figures, which give the average of forty-four analyses collected by König:

Water.	Proteids.	Fat.	Sugar.	Gum.	Starch.	Cellulose.	Ash.
15.26	11.43	1.71	0.95	4.88	61.99	2.01	1.77

However, the gluten of wheat is superior in quality to that of rye. In those countries whose inhabitants are compelled to depend largely upon rye bread, there is much suffering at times from poisoning with ergot. Fortunately, this poison is not found to any extent in wheat.

Oat meal, which has been used as a food in Scotland for a long time, is now being largely consumed in the United States, and it is to be hoped that its use will become more universal. It is a highly nutritious, healthy, and cheap article of diet. The average composition of the grain is as follows:

Water.	Proteids.	Fat.	Sugar.	Gum.	Starch.	Cellulose.	Ash.
12.37	10.41	5.23	1.91	1.79	54.08	11.19	3.02

It will be noticed that the amount of fat is much larger than in wheat or rye. In the best specimens of the grain the fat may be as much as 8 per cent.

Corn is largely used in some of the Southern states, and, in the various ways in which the people know so well how to prepare it, it forms a most valuable food. The exact composition varies considerably with the variety of the plant and the soil on which it grows; but the following are the average figures:

Water.	Proteids.	Fat.	Sugar.	Gum.	Starch.	Cellulose.	Ash.
13.12	9.85	4.62	2.46	3.38	62.57	2.49	1.51

The greater part of the nitrogenous material consists of vegetable fibrine.

Rice grains have the following average composition:

Water.	Proteids.	Fat.	Starch.	Gum.	Cellulose.	Ash.
9.55	5.87	1.84	73.00	2.85	5.80	1.09

Since the per cents. of both proteids and fats are low, it must be regarded as the least nutritious of the grains here mentioned. However, its ease of digestion renders it valuable to the sick; and the fact that its heat-producing power is not so great as the other grains, adapts it to the inhabitants of warm countries.

Barley, which is so largely used by the Scandinavians, and millet, which is a staple food in India and some other warm countries, are so seldom used in this country as foods that an extended notice of them is unnecessary.

Buckwheat does not belong to the cereals, but to a wholly different class. However, as it is a food which is highly prized by many, it deserves mention. The plant soon reaches maturity, and may be grown upon poor, sandy soil, as well as upon richer ground. The average composition is shown by the following figures:

Water.	Proteids.	Fat.	Gum.	Starch.	Cellulose.	Ash.
12.63	10.19	1.28	2.85	69.30	1.51	2.24

The albuminous substances found in buckwheat differ materially from those present in the cereals. Its food value is not so great as that of wheat, rye, or oats.

FLOUR AND MEAL.

By grinding, the grains which have been described are converted into flour or meal. By this process the food material is better fitted for cooking, and is to some extent separated from the indigestible portions. A few simple rules will be given by which good flour or meal may be distinguished from the inferior grades:

(1) Good wheat flour is white, with only a faint yellow tint. It does not contain any bluish, grayish, or dark specks. It feels soft and dry to the finger, and when some is pressed in the closed hand, it forms a dry lump, which breaks down readily with the gentlest pressure. If it fails to form a lump when pressed in the hand, it contains too much bran, or some mineral adulteration has been added. When the finger is introduced vertically into good flour, the depression thus made remains; otherwise, there is too much bran present. The odor is fresh and pleasant, not musty. Neither with the unaided eye nor with a magnifying glass will any living bodies be found in good flour.

(2) Rye flour has a grayish tint, and a characteristic odor and taste. The other general properties are identical with those of wheat flour.

(3) The color of corn meal varies with the variety of corn from which it is prepared. It should feel perfectly dry and powdery. It does not "lump" when pressed in the hand, and it has a characteristic, pleasant odor. Corn meal, when decomposition has begun, has a rancid odor, and if some of it be placed upon a piece of moistened blue litmus paper (which can be obtained at any drug store), the color of the paper will be

changed to red. Good meal has no effect on the color of the litmus paper.

(4) Oat meal should be dry, and free from any disagreeable odor.

The Care of Meal and Flour. When exposed to the air, flour and meal absorb water, and this greatly increases their tendency to decompose. In moist flour the lower forms of life are likely to develop. For these reasons these preparations should be kept in well closed receptacles.

Adulteration. Fortunately, these foods are very rarely adulterated in this country. Since wires have been used so extensively for binding in the great wheat fields of the North-west, a small amount of iron is found in flour, as an accidental adulteration. It is frequently stated that gypsum and other mineral substances are added to flour, but the writer has examined many hundred samples, and has never detected such an adulteration. It has also been stated that the so-called "patent flour" contains alum. This is certainly false. One of the writer's students examined twenty-three samples of "patent flour" obtained at different places, and failed to find any alum present. It may be possible that in some instances the cheaper flours or meals are added to wheat flour; but even this fraud, if practised at all in this country, is carried on to a very limited extent. The great abundance and low price of wheat would tend to make any adulteration profitless.

BREAD.

The cooking of his food is one of the earliest evidences of man's civilization, and with no other food has the process of cooking been so thoroughly developed as with the products obtained from the edible grains. The essential constituents of bread are flour, water, and salt. To these have been added, for the purpose of varying and improving the taste, one or more of the following substances: Milk, sugar, eggs, fats, etherial oils, and fruits. Civilized man, in every part of the world, employs some means of raising or leavening his bread. By this the taste is improved, and the crumb, being divided by the evolved gas, is more readily acted upon by the digestive juices. The methods of raising bread are as follows:

(1) By the Growth of Yeast. Yeast consists of microscopic vegetable organisms, which, when placed in a suitable medium, grow rapidly, producing alcohol and carbonic acid gas. The evolved gas, in attempting to rise, becomes entangled in the meshes of the dough, distending it and making it light. After the dough has risen sufficiently, it is placed in a hot oven to bake. The heat destroys the yeast plant, and thus prevents further fermentation. If the growth of the yeast be allowed to continue for too long a time, acetic, lactic, and butyric acids are formed, and such dough makes "sour bread."

(2) By Baking Powders. In the use of baking powders, the carbonic acid gas, necessary to render the dough light, is generated by chemical means. Baking powders consist of some alkaline carbonate,

as sodium bicarbonate, and some acid substance, such as the acid tartrate of potash (cream of tartar), together with a small amount of starch to keep the mixture dry. As long as the powder is perfectly dry no reaction occurs, but when it is dissolved in water in the dough, the acid acts upon the carbonate, liberating carbonic acid, which has the same effect in raising the dough as when it is produced by the growth of the yeast plant.

In baking powders, ammonium carbonate is sometimes used instead of sodium bicarbonate; and the acid tartrate may be replaced by the acid phosphate of lime. But the use of alum in baking powders is an adulteration which is injurious to health. It unites with the phosphates in the bread, rendering them insoluble, and preventing their digestion and absorption. In this way alum, when present, diminishes the nutritive value of bread.

A small amount of starch in baking powders is necessary to keep them dry, but too often the manufacturer adds as much starch as possible, and this should be considered as an adulteration.

(3) By Aeration. In some large bakeries carbonic acid gas, generated by the action of some acid on carbonate of lime, is forced under pressure into the dough, thus distending the mass; or the dough is kneaded with water which has been saturated with carbonic acid under pressure. When the gas is washed before being forced into the dough or water, this method is a very desirable one. But the cost and care of the special apparatus necessary will prevent the adoption of this method of raising bread, except in large bakeries and hotels.

General Properties of Good Bread. The general statements concerning bread refer to that made from wheat flour. Good bread has a thick, fragile crust, which is not burnt, and which forms from 25 to 30 per cent. of the weight of the loaf. The crumb is white, and filled with cavities, the partitions between which are easily broken down. These cavities should be distributed through every part of the crumb; otherwise, the bread is sodden and heavy, and decomposes quickly. The bread should be of a pleasant odor and taste. If the bread is acid, it was probably made from inferior flour.

Changes on Standing. On standing, bread gradually loses weight, by the evaporation of a part of its contained water, and becomes hard. The amount of water given off in a certain time will depend upon the size of the loaf and the nature and extent of the crust. Bread should not lose more than 3 per cent. of its original weight after four days. Stale bread when dipped in water and rebaked, or when steamed, becomes palatable, but never completely regains the properties of fresh bread. In stale bread, small living organisms are likely to develop. Some of them are poisonous. The white and orange-yellow moulds which form on stale bread are due to a poisonous growth. Sometimes blood-red spots appear in bread. These also are due to a microscopic growth.

Adulterations of Bread. Bread is not adulterated to any great extent in this country. The baker's loaf is usually of light weight. An excess

of water is often incorporated with the dough. This makes the bread sodden and heavy, and increases its liability to decompose. In some of the larger cities, mashed potato has been found worked into bread. This lowers the nutritive value of the article greatly. Alum is sometimes added directly to flour or dough, and is sometimes contained in the baking powder, as has been stated.

The Food Value of Bread. As has been remarked, the most important food constituents of the grains, and consequently of bread, are the proteids, starches, and ash. The amount of nitrogenous matter is too small for a perfect food, and for this reason bread is often taken with some other food richer in nitrogen, such as meat. Bread is also deficient in fat, and man instinctively takes some kind of fat, such as butter or bacon, along with his bread. Notwithstanding these imperfections, bread is a food of which we never tire, and the various ways in which it is prepared aid in sharpening the appetite. Besides, while some important food substances are not abundant in bread, all are present to a greater or less extent; and with the addition of a little more nitrogen in the shape of meat and fat, as butter or bacon, a perfect diet is secured.

PEASE AND BEANS.

Pease and beans belong to the leguminous seeds. They contain more nitrogenous matter or proteids than any other vegetable food. Not only is the amount of proteid greater than in wheat and other grains, but it is different in its properties. That of the grains is principally gluten, while that of pease and beans belong to the casein group. The former is more easily digested than the latter, pease and beans often causing disturbances in the stomach and bowels. The average composition of these foods is shown by the following figures:

PEASE.

Water.	Proteids.	Fat.	Starch.	Cellulose.	Ash.
14.99	24.04	1.61	49.01	7.09	3.26.

BEANS.

Water.	Proteids.	Fat.	Starch.	Cellulose.	Ash.
14.76	24.27	1.61	49.01	7.09	3.26

There is great difference between the digestibility in these substances in the green and in the dried state. Soft green pease tax the stomach but slightly. Dried pease and beans must be boiled slowly and for a long time; and if they are very old, they should be soaked for several hours, and then crushed before they are cooked. Hard water is to be avoided in cooking them, as the lime of the water forms an insoluble compound with the albuminous constituents of the seeds.

Ground pease and beans are used to some extent in this country. They form a part of some food preparations, such as pea-sausage (erbswürste of the Germans).

Food Value of Pease and Beans. The nutritive value of the seeds is considerable, but on account of the tax which they impose upon the digestive organs, they cannot be taken in large quantities. The deficiency of fat is usually supplied by serving these foods with bacon or other fatty food.

POTATOES.

Potatoes contain only about 25 per cent. of solids, four and five-tenths of which is starch. The per cent. of nitrogenous matter and fat is small as shown by the following figures, which give the average per cent. composition of potatoes:

Water.	Proteids.	Fat.	Starch.	Cellulose.	Ash.
75.77	1.79	0.16	20.56	0.75	0.97

Notwithstanding its comparatively small per cent. of solids, the potato will continue to be one of the most valuable foods. Its growth is not influenced by soil and climate to such an extent as that of the cereals. The yield of the potato per acre is greater than that of any other vegetable. It is preserved with ease for winter's use, and the raw material is fitted for the table with but little trouble and expense. It can be served in a great variety of ways, and with other foods. Its deficiency in nitrogenous matter and fat is made up by cooking it with meat. It is agreeable to the taste, and easy of digestion. New potatoes are said to be waxy, and not so easily digested as old, mealy ones. In order to retain the salts, potatoes should be cooked with their skins on. If boiled, they should at once be placed in hot water. If baked, the oven must be moderately hot.

Potatoes should be of fair size, firm, and free from mould. The sweet potato is similar in composition to the ordinary potato, and furnishes an agreeable substitute: but it is more expensive, and cannot be preserved so easily

OTHER VEGETABLES.

The other succulent vegetables which are used as foods are principally useful on account of furnishing variety, and for the acid salts which they contain, and whose use renders other foods more digestible, and prevents scurvy and kindred affections.

The beet root is not only a pleasant food, but furnishes as much as 10 per cent. of sugar, for which it is now largely grown; though the different varieties of the root vary considerably in the amount of sugar which they contain.

Turnips, carrots, and parsnips contain from 82 to 90 per cent. of water, from 5 to 10 per cent. of starch, from 2 to 6 per cent. of sugar, about 1 per cent. each of nitrogenous matter and salts, and ½ per cent. or less of fat.

Cabbage, turnip tops, spinach, water-cresses, dandelion, and other greens" should always be thoroughly cooked. The amount of absorbable food which they contain is generally less than 5 per cent.

The tomato, either raw or cooked, furnishes an agreeable sauce. It is also used for making soup and for flavoring meat soups. It contains over 92 per cent. of water, less than 2 per cent. of starch, and about $2\frac{1}{2}$ per cent. of sugar.

Rhubarb is a pleasant, acid vegetable, which is especially serviceable on account of its being one of the earliest of spring plants.

Pumpkins and squash contain from 1 to 5 per cent. of starch, about 1 per cent. of sugar, and less than 1 per cent. each of nitrogenous matter, fat, and ash.

Thoroughly ripe melons are beneficial in season on account of their action upon the kidneys. They should never be eaten, however, unless they are thoroughly ripe and of good quality.

STARCHES.

The food value of the starches is small, but they are easy of digestion, and are serviceable in preparing dishes for the sick. Besides, when mixed with nitrogenous and fatty substances, they are largely used in making puddings. In this way, stale bread and other remnants from the table may be converted into palatable dishes.

Sago and arrow-root are obtained from various palms. The former appears in small granular masses, which, when dry, are so hard that they can scarcely be crushed by the teeth; but they readily absorb water, and soften.

Arrow-root, when pure, is found in perfectly white lumps, which may readily be crushed between the fingers. When boiled with water and constantly stirred, no foam should form on the surface. The presence of a foam indicates that the arrow-root has been adulterated with flour.

Tapioca, obtained from various tropical plants, and corn and potato starches, are also used in puddings.

SUGARS.

Sugar is a name now given to a class of substances which vary among themselves to some extent both in physical and chemical properties, though ordinarily the term "sugar" is supposed to refer to that obtained from the sugar-cane and sugar beet. Practically there are now in the trade three kinds of sugar,—cane sugar (obtained from the cane and beet), glucose or grape sugar (obtained by the action of dilute acids on starch), and "mixed sugars," or "new-process sugars" (consisting of cane and grape sugar mixed in various proportions). Cane sugar is here referred to, unless some other is specifically mentioned.

Sugar is used for modifying the taste of other foods, and for the manufacture of confectionery and syrups. By improving the taste, sugar, when added in proper amounts, aids the digestion of other substances, and furnishes a certain amount of nutriment in itself.

Good, crystalline, white sugar contains less than one half of 1 per

cent. of water, and not more than this amount of ash. Yellow sugar may contain as much as 2 per cent. of water.

Grape sugar may contain from 10 to 25 per cent. of water, and from one half to 2 per cent. of ash.

Much has been said about the adulteration of sugar with glucose. That this has been practised to a considerable extent is shown by numerous analyses. Indeed, "mixed sugars" are sold by wholesale dealers, and too frequently the retail grocery-man sells these to his customers as straight cane sugars.

Experts can recognize these sugars by the way they "handle." "They are apt to cake and harden, and stick to the scoop and sides of the barrel. In the white, granulated sugars, the mixture of the white lumps of glucose with the crystalline cane sugar can be readily seen; but in the brown sugars it is difficult to detect the fraud by the appearance of the sugar. When a mixed sugar is shaken with cold water, the white lumps of the glucose will remain undissolved for some time after all the cane-sugar has passed into solution."

Glucose, when made with care,—and it must be so made when it is used to adulterate sugar,—is not harmful to health. The fraud is a pecuniary one, as glucose costs usually less than two cents per pound; but when mixed with sugar, it is sold for six cents and more per pound. The sweetening properties of glucose are not so great as those of cane sugar, and consequently, in the preparation of foods, much more of the mixed sugar is required than would be necessary with cane sugar.

Confectionery. The various candies are made from sugar, or sugar and starch, with or without coloring matters. Twenty-seven samples were examined under the writer's direction, in order to ascertain whether or not they contained any poisonous substance. One sample consisted wholly of starch, terra alba, and an analine color, without any sugar. The use of terra alba (white earth, or clay) in any considerable amount would be harmful on account of its indigestibility. Only two samples contained ultra marine as a coloring agent. This would also be harmful if used in large quantity. The other samples were all free from any suspicious ingredient. The coloring agent most frequently used is analine. Grape sugar is extensively employed in the manufacture of confectionery.

Honey. This is frequently adulterated with glucose, which may be added directly to strained honey, or may be fed to the bees, and by them deposited in the comb. Unadulterated honey varies in flavor according to the plant from which it is gathered. White clover and buckwheat honeys are much prized in this country. The fact that honey sometimes produces unpleasant symptoms is probably due to bees feeding upon poisonous flowers, though the susceptibility of the individual partaking of it probably plays an important part. Pollen grains are often mixed with honey, and the unpleasant effects upon the system may be, in part at least, due to these.

Molasses and Syrups. These are solutions of sugar, and they are now frequently made by a mixture of cane syrup and glucose. Indeed, many

prefer a syrup containing glucose: it is not so sweet as a pure cane-sugar molasses. However, the former should be much cheaper than the latter. As in the case of sugar, the fraud here practised is a pecuniary one rather than one detrimental to health.

FRUITS.

Fruits abound in tropical and temperate climates, and furnish a great variety of flavors, which are useful in themselves and for the purpose of rendering other foods more enjoyable. The real food value of fruits, judged by their chemical composition, is small, but when thoroughly ripe and well preserved, they act beneficially upon the system, improving the appetite, and maintaining a healthy condition of the various vital organs. Probably no fruit is necessary to life, and fruits may be regarded as luxuries; but man's instinct and cravings prompt him to obtain them often, even when their cost is considerable. Undoubtedly they are most highly prized by the inhabitants of warm countries, where foods which produce but little heat are most desirable. The most enjoyable part of fruits is their juice, which consists principally of watery solutions of sugar and acids. The amount of sugar in fruits varies from 1 to 18 per cent. The cellular parts are not easily digested; and those fruits are prized most highly which have the greatest quantity of juice with the smallest proportion of cell structure.

The majority of fruits may be eaten either raw or cooked, and those which cannot be preserved in their natural condition may be dried. Therefore, in one or the other form, they may be enjoyed at any season of the year, and may be served with other foods.

The volatile ethers, upon which the flavor of many fruits depends, have been made artificially by the chemist, and, under the name of essences, are largely used in cooking.

It is wholly unnecessary even to mention the various fruits in use, as all are sufficiently acquainted with their general properties and composition. Suffice it to say, that thoroughly ripe fruit, taken in moderation, can have no deleterious effect upon the system. However, care should be exercised in using fruits imported from countries in which an infectious disease, such as cholera, prevails. Such fruit should at least be thoroughly washed, or stripped of its covering, and, if suitable for such purpose, should be cooked.

Canned Fruits. In buying canned fruits, it should be observed that the ends of the cans are concave. If convex, there has probably been some decomposition of the contents with the evolution of gas. Cases of severe poisoning have followed the eating of partially decomposed canned fruits. Moreover, if the cans appear old and battered, thus giving evidence of having been used twice or oftener for the purpose of preserving fruit, they should be rejected, since the contents of such cans are liable to contain small amounts of tin or other metal, which may prove poisonous. Much having been said about the use of salicylic acid, in canned fruits,

as a preservative agent, the writer requested one of his students to examine samples from all the more prominent firms engaged in the preparation of canned foods, for this adulteration. In no case was the acid found. Frequently agents pass through the country, offering to sell preparations or recipes for the sure preservation of fruit. The active ingredient of all these formulas is salicylic acid or some form of sulphurous acid. The use of such preservatives is unnecessary. Moreover, they injure the taste of the fruit, and are liable to prove deleterious to the health of the consumer.

Prof. Sharpless states that "apple-sauce" is frequently pumpkin boiled with cider; that the raspberry-jam offered for sale is often sour; and that strawberry-jam is frequently made from the refuse strawberries of the market.

NUTS.

Judging solely by chemical composition, nuts should be classed among the most nutritious foods. The following figures give the percentage composition of sweet almonds, walnuts, and hazelnuts, from numerous analyses collected by König:

	Water.	Proteids.	Fat.	Starch and Sugar.	Cellulose.	Ash.
Almonds, ...	5.39	24.18	53.68	7.23	6.56	2.96
Walnuts, ...	4.68	16.37	62.86	7.89	6.17	2.03
Hazelnuts, ...	3.77	15.62	66.47	9.03	3.28	1.83

But nuts are not easily digested, and, with the exception of cocoa-nuts, do not form an important part of the food of any people. They may be regarded simply as luxuries, so far as their use in this country is concerned. Crushed acorns are used to some extent in the adulteration of ground coffee.

VEGETABLE OILS.

On account of our abundant supply of animal fats, the vegetable oils are not extensively used as foods in this country. The one best known is olive oil, which is used as a dressing for other foods. Olive oil, however, has been largely adulterated, or supplanted, by cotton-seed oil, large quantities of which are sold as olive oil.

CONDIMENTS.

Condiments are substances whose employment in cooking is for the sole purpose of seasoning foods. However, at least one member of this class,—common salt,—is essential to healthy existence. Condiments improve the taste of foods, sharpen the appetite, and improve digestion. While much benefit arises from this use in small amounts, when taken in excess they may prove highly detrimental to health.

It is stated that certain tribes in the interior of Africa exchange gold for salt, ounce for ounce. This illustrates the great need of this substance felt by the animal system. We know that wild animals some-

times travel hundreds of miles in search of salt-licks. Experiments have been made, in which two oxen were placed under exactly the same conditions, and furnished with the same food, save that salt was denied one, and given to the other. The one deprived of salt did not thrive as did the other.

The purity of salt is judged of by its whiteness, fineness, dryness, and perfect solubility in water. The coarser kinds of salt contain compounds of lime and magnesium, are often dark in color, and absorb moisture from the atmosphere.

Vinegar is an acid fluid, which may be produced by the fermentation of any solution containing sugar. Cider and wine vinegars are most highly prized, though the following varieties are now sold in this country:

(1) Cider vinegar, from apples and pears.

(2) Wine vinegar, from grape juice and inferior wines.

(3) Malt vinegar, from barley.

(4) Beer vinegar, from sour ale or beer.

(5) Glucose vinegar, from grape sugar.

(6) Crab vinegar, from crab-apples.

(7) Artificial vinegar, made with dilute solutions of the mineral acids, especially sulphuric acid.

The acidity of vinegar is nominally due to acetic acid. Sulphuric acid is sometimes added to increase the acidity. The British law allows this adulteration to the extent of one tenth of one per cent.; but if the vinegar be properly prepared, such an addition is not necessary; and if any addition be allowed, the amount is likely to exceed that given above. Burnt sugar is sometimes added to vinegar to give it color.

The per cent. of acetic acid should be at least 3. Of five samples recently examined, the smallest per cent. was 3.2, and the greatest, 6.7. Only minute traces of mineral acids were found in three of these samples, while the other two were wholly free from such adulteration.

Table mustards are frequently diluted with tumeric, flour, or yellow lakes. Pepper is sometimes mixed with flour, bread, or starch. Spices are frequently adulterated with flour, starch, bread, and ground pea-nut shells. Cloves may contain arrow-root. In order to obtain spices pure, they should be purchased unground.

TEA.

Tea is the most extensively used and the least harmful of all beverages. Upon most persons it produces agreeable sensations; "it cheers, but does not inebriate." It relieves, to a certain extent at least, the feeling of bodily weariness, quickens the pulse, and deepens the respiration. Upon the nervous system it acts as a stimulant, and the excitation is not, as in the case of alcoholic drinks, followed by depression. Considerable discussion has been carried on over the question whether or not its use increases waste of tissue. This may now be considered as settled in the affirmative. Dr. E. Smith and others have repeatedly shown that the

amount of waste matter in the air exhaled from the lungs is markedly increased. Tea, then, acts as a food principally by hastening the oxidation or burning of other substances in the body.

It creates a blast which burns up the half charred *débris* of the system, and from the burning or oxidation we receive increased energy. From what has been said, it will be evident that the only time when tea should be used is late in the day, after the heaviest meals have been taken. For the weak and debilitated it is not suitable, or should be used very sparingly. Its tendency to produce sleeplessness may also restrict its use.

So far as its chemical composition is concerned, tea contains but little of nutritive value. The high place of tea among foods is solely due to its effect upon the nervous system.

In the market there are two kinds of tea,—green and black. Until recently it was supposed that these were products of different species, or at least of varieties, of the tea plant; but it is now known that the two kinds arise from different methods of curing the leaves. In preparing green tea, the leaves are dried immediately; while in the other, the leaves are thrown into heaps, and a certain degree of fermentation or decomposition is allowed to take place before the drying is perfected.

The chief constituents of tea are its active principle called theine, which is identical with the active principle of coffee, a volatile oil, tannic acid, and a small amount of ordinary food substances.

Theine forms from 2 to 3 per cent. of tea. In making tea, as is ordinarily done, the greater part of the theine is dissolved out of the leaves,—tea yielding its active principle to water more readily than coffee. From equal weights, three times as much theine is obtained from tea as from coffee. According to the investigations of Mr. Fellows, 224 five-ounce cups of tea beverage are made from one pound of tea, and 45 eight-ounce cups from a pound of coffee. This makes the cost of an ordinary cup of tea, when the leaf sells at 75 cents per pound, about one third of a cent; and of a cup of coffee, when the berry sells at 27 cents per pound, about three fifths of a cent. In this estimation the sugar and milk added to these beverages are not considered.

The volatile oil of tea is the special stimulant, and the market value of a tea depends more upon this than any other constituent. The amount and quality of this substance present are judged by the odor as well as by the taste of the hot beverage. Large tea houses have experts who are called "tea-tasters," and whose duties consist of deciding as to the value of different samples by the odor and taste. By virtue of the volatile oil, tea increases the flow of perspiration, and thus, although taken hot, may act as a cooling agent. The volatile oil is more abundant in green than in black tea.

Tannin is also more abundant in green than in black tea. The object in making tea should be to dissolve as little of the tannin as possible, and at the same time extract as much as possible of the theine and volatile oil. To accomplish this, tea should be steeped five or ten minutes, by no means longer than ten minutes; but the water should be kept warm after

that until the beverage is drawn for drinking. Mr. Fellows found the amount of tannin extracted from the best Japan tea, after steeping for five minutes, to be 0.10 per cent.; after ten minutes, 0.98 per cent.; after thirty minutes, 3.09 per cent. It is to the tannin that the astringent properties of tea are due, and when tea has been boiled, it is so astringent that it is well-nigh unfit for use, and indeed may cause derangements of the digestive organs.

Tea contains small amounts of albuminous and starchy substances, but, as has been stated, these are present in such small amounts that they are not worthy of consideration.

Tea is subject to the following adulterations, which, fortunately, are not largely used at present:

(1) "Spent" leaves, those which have been once used for making tea, are dried, and mixed with fresh leaves. This adulteration is not practised extensively in this country.

(2) The poorer varieties are mixed with the better, and the whole sold as of first quality.

(3) Green tea is sometime tinted with indigo and gypsum Prussian blue is said also to be used, but the writer has failed to detect it after examining many samples. Black tea is also tinted with graphite. This is not used in large amounts, and, as used, is not detrimental to health, but is a pecuniary fraud.

(4) Other leaves, notably those of the willow, elder, and beech, are added to the tea leaves. None of these are exactly like the tea leaf, and the adulteration may be detected by close inspection, even without a microscope. The border of the tea leaf is serrated nearly, but not quite, to the stalk. The primary veins run from the midrib nearly to the border, and turn in so that there is a distinct space left between their terminations and the border.

Tea dust, which consists of broken leaves and sweepings of tea storage houses, is a legitimate article of commerce, yielding an average of 1.27 per cent. of theine.

COFFEE.

It is unnecessary to go into detail concerning coffee, since it resembles tea in so many of its properties. The active principle of coffee, called caffeine, is identical in chemical composition and physiological effects with theine of tea. The per cent. of this substance in the raw coffee berry is about one, and this is not given up so readily to water as that in tea.

There is no volatile oil, corresponding to that of tea, in raw coffee; but one or more such oils are generated by roasting. The physiological action is not the same, however, as that of tea. It is not so stimulating, nor does it increase the perspiration to so great an extent.

Tannin is present in a much smaller amount than in tea, and for this reason the steeping of coffee may be carried on longer than ten minutes.

The unground coffee cannot be adulterated to any extent; but the ground coffee put in packages and boxes is almost universally adulterated.

Often it contains no coffee at all. A student of the writer examined all the specimens that could be obtained in the market. The first, known as Java coffee, put up by the "Centennial Coffee Company," of New York, contained, besides some coffee, chickory, pease, wheat, acorns, and corn. The second, "Gillies Gold Medal Java," contained very little coffee, being composed principally of wheat, much of it unground chickory, corn, and pease. The remaining samples were ground coffee, sold in bulk, and in every case adulterated.

CHOCOLATE.

Chocolate is prepared from the ground seeds of the fruit of the cocoa palm. Cocoa nibs consist of these seeds, which are about the size of almonds, roughly broken, while chocolate contains a substance,—theobromine,—very similar, but not identical with theine or caffeine; its other constituents give it a very different position in the class of foods. The cocoa seeds contain from 45 to 49 per cent. of fat, and from 14 to 18 per cent. of nitrogenous matter. It will be seen from this that these seeds may be classed among the most nutritious foods. Chocolate always contains sugar, which has been mixed with the ground seeds.

Chocolate does not stimulate the nervous system to anything like the extent that tea and coffee do; but for travellers and others who cannot obtain milk, chocolate may be used instead of that, the most nutritious of liquid food.

Chocolate is often adulterated by the addition of too much sugar, or with starch.

TESTIMONIALS.

The following are among the *unsolicited* endorsements already received:

S. H. Durgin, Health Officer, Boston, Mass.:

"The volume is full of valuable material worth double its price."

Hon. Erastus Brooks, West New Brighton, N. Y.:

"The prize essay volume is most excellent for the people and for all interested in the questions discussed. Compilation and publication are all that could be desired."

Prof. R. D. Kedzie, M. D., Lansing, Mich.:

"Am pleased with the appearance of the volume, and promise myself much pleasure in its perusal."

S. A. Evans, M. D., Conway, N. H.:

"It seems to me very desirable that these essays should be in every family. Could not the substance of them be embodied in a school text-book and used in our schools? If the young could be educated in the subject, it would be an excellent provision for the future."

D. O. Smith, M. D., Hudson Centre, N. H.:

"The work is invaluable to the rising generation, professional and otherwise."

T. E. Sanger, M. D., Littleton, N. H.:

"Think it ought to be in the hands of every board of health and of education."

Nathan Allen, M. D., LL. D., Lowell, Mass.:

"A most valuable work, especially the paper on American Manufactories and Workshops."

Ed. Wm. Germer, M. D., Pres. St. Bd. of Health, Erie, Penn.:

"It is an excellent book, and ought to be translated into German and French and Swedish languages to reach the masses of the people."

Prof. C. A. Lindsley, M. D., Sec'y St. Board of Health, New Haven, Conn.:

"You have given us a capital volume. Some benevolent man of money ought to steer one into the family of every householder in the land."

Crosby Gray, Esq., Health Officer, Pittsburgh, Penn.:

"A most valuable work."

L. W. Hubbard, M. D., Lyndon, Vt.:

"I am much pleased with the volume, and hope to induce some of our citizens to send for it."

W. A. Haskell, M. D., Alton, Ill.:

"The work is in every respect a credit to the Association."

L. H. Cohen, M. D., Quincy, Ill.:

"Book received in good condition. Expect to derive much pleasure and information from its careful perusal."

Geo. M. Cox, M. D., member St. Bd. of Health, Springfield, Mo.:

"I am highly delighted with the volume, and consider it a dollar well spent."

C. W. Chancellor, M. D., Sec'y St. Bd. of Health, Baltimore, Md.:

"A handsome and valuable volume."

B. W. PALMER, M. D., Detroit, Mich.:

I shall take pleasure in commending the volume to my medical friends. It is really unique in the thoroughness and practical suggestiveness of the important subjects discussed."

ALBERT L. GIHON, M. D., Medical Director U. S. N., Washington, D. C.:

"In the publication of the Lomb Prize Essays the American Public Health Association has entered upon the practical stage of its work as the conservator of the public health. I trust the admirable series of monographs thus initiated will be continued, until sanitary treatises of this high character may, through their cheapness, excellence, and attractiveness, be found among the household authorities in every part of the country."

A. E. WINCHELL, M. D., member Board of Health, New Haven, Conn.:

"Its perusal affords great pleasure. It should be in the hands of every physician and sanitarian."

W. R. SPEARE, Esq., Washington, D. C.:

"I am much pleased with it."

F. F. PRESTON, M. D., New Haven, Vt.:

"It is a volume of great value, and ought to be in every American home."

CHARLES AMBROOK, M. D., Boulder, Col.:

"A very valuable work, and cheap."

T. E. MILLER, M. D., Westport, Ind.:

"The more I read your book, the better I like it."

H. C. CROWDER, M. D., member St. Bd. of Health, Williams, Cal.:

"I am very much pleased with the Lomb Prize Essays, and would earnestly recommend that a copy be in every public school library as well as in every physician's. I congratulate you on your valuable book."

ALBERT MERRELL, M. D., St. Louis, Mo.:

"The essays are valuable contributions to sanitary science, and should be widely circulated."

A. E. ABRAMS, M. D., Collinsville, Conn.:

"These essays will go very far toward enlightening all classes of citizens on the very important topics of which they treat."

CHAS. F. WINGATE, C. E., New York city:

"An admirable summary of facts clearly expressed, and suitable for popular enlightenment."

HENRY SHIMER, M. D., Mt. Carroll, Ill.:

"I am glad that I concluded to send for the work. It is valuable for everybody."

H. S. ORME, M. D., Pres. St. Bd. of Health, Los Angeles, Cal.:

"The prize essays are excellent, and just what I wanted for reference."

EDITOR BUILDING, New York city:

"Shall take pleasure in reviewing this interesting work, and possibly make extracts unless you object to our doing so."

WALTER F. WELLS, Esq., Winthrop, Mass.:

"I consider it a valuable book, and wish it was in every household."

GERRARD G. TYRRELL, M. D., Sec'y St. Bd. of Health, Sacramento, Cal.:

"The volume is admirable, and wonderfully cheap."

THE AMERICAN PUBLIC HEALTH ASSOCIATION,

Organized in 1872 by a few eminent sanitarians, has grown in fourteen years to be the strongest and ablest association of its kind in America, if not in the world, and contains in its list of members, physicians, lawyers, clergymen, teachers, engineers, architects, and representatives of other trades and professions. Its influence has been felt in the legislative halls of the nation, as well as in every state and territory, for the amelioration of sickness and suffering, and the prolongation of human life.

The eleven large and elegant volumes it has published are in themselves a monument to American hygiene, while their precepts and teachings have been felt through all ranks and grades of society, from the workshop to the mansion of the millionaire. No library is complete in its literature of sanitation without these works.

Each member of the Association receives a copy of the annual volume free of expense. This work alone is worth more to any individual than the cost of membership.

Information relating to the Association, as well as blank applications for membership, may be obtained by addressing the Secretary, Dr. Irving A. Watson, Concord, N. H.

EXTRACT FROM CONSTITUTION. Art. III.

The members of this Association shall be known as Active and Associate. The Executive Committee shall determine for which class a candidate shall be proposed. The *Active* members shall constitute the permanent body of the Association, subject to the provisions of the Constitution as to continuance in membership. They shall be selected with special reference to their acknowledged interest in or devotion to sanitary studies and allied sciences, and to the practical application of the same. The *Associate* members shall be elected with special reference to their general interest only in sanitary science, and shall have all the privileges and publications of the Association, but shall not be entitled to vote. All members shall be elected as follows:—

Each candidate for admission shall first be proposed to the Executive Committee in writing (which may be done at any time), with a statement of the business or profession, and special qualifications, of the persons so proposed. On recommendation of a majority of the committee, and on receiving a vote of two thirds of the members present at a regular meeting, the candidate shall be declared duly elected a member of the Association. The annual fee of membership, in either class, shall be five dollars.